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United States Department of Energy

Savannah River Site

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DIVISION OF SITE  
ASSESSMENT & REMEDIATION

**Interim Record of Decision  
Remedial Alternative Selection for the  
A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit  
(731-2A) (U)**

**WSRC-RP-2000-4001**

**Revision 1**

**April 2000**

Prepared by:  
Westinghouse Savannah River Company, LLC  
Savannah River Site  
Aiken, SC 29808

Prepared for U.S. Department of Energy under Contract No. DE-AC09-96SR18500



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**INTERIM RECORD OF DECISION  
REMEDIAL ALTERNATIVE SELECTION (U)**

**A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) (U)**

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Aiken, South Carolina**

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**Westinghouse Savannah River Company, LLC**

**for the**

**U. S. Department of Energy Under Contract DE-AC09-96SR18500**

**Savannah River Operations Office**

**Aiken, South Carolina**

## **DECLARATION FOR THE INTERIM RECORD OF DECISION**

### ***Unit Name and Location***

A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) Operable Unit

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU-19

Savannah River Site

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Identification Number: SC1890008989

Aiken, South Carolina

United States Department of Energy

The A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) Operable Unit (OU)(ABRP) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS) in Aiken County, South Carolina. The following media are associated with this OU: surface soil and groundwater.

An SRS RCRA permit modification is not required at this time since this is an interim action. However, the final permit modification will (1) include the final selection of remedial alternatives under RCRA, (2) be sought for the entire ABRP with the final Statement of Basis/Proposed Plan (SB/PP), and (3) will include the necessary public involvement and regulatory approvals. This Interim Record of Decision (IROD) also satisfies the RCRA requirements for an Interim Measures Work Plan

### ***Statement of Basis and Purpose***

This decision document presents the selected interim remedy for the ABRP in Aiken County, South Carolina. The interim remedy was chosen in accordance with CERCLA, as amended by Superfund Amendments Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this site.

The State of South Carolina concurs with the selected remedy.

***Assessment of the Site***

The response action selected in this IROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

***Description of the Selected Remedy***

The preferred alternatives for the ABRP are

- **Surface Soil:** Alternative 4S, Soil Cover over Pit 731-2A, with Institutional Controls which consists of a one-foot thick soil cover over Pit 731-2A with Land Use Controls to maintain industrial future land use. The estimated present value cost is \$213,208. The estimated installation time is less than one year.
- **Groundwater:** Alternative 4/5GW. Active Air Sparging with Passive/Active Soil Vapor Extraction (BaroBall™ Wells) and Enhanced Biodegradation, Carbon Adsorption for Offgas Treatment, and Monitoring, which is a combination of active air sparging with passive or active soil vapor extraction. The groundwater treatment will be applied in a phased approach. The estimated present value cost is \$3,164,231. The estimated operating time is 5 years.

There is no principal threat source material (PTSM) at the ABRP. Based on the ABRP RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report with Baseline Risk Assessment (BRA) (WSRC 1997a), the ABRP poses a  $6 \times 10^{-5}$  risk to current and future workers through dermal contact and ingestion of surface soil contaminated with benzo(a)pyrene (BAP). The surface soil remedy consists of a one-foot thick soil cover over Pit 731- 2A to eliminate risk from BAP contamination in the surface soil to the current workers during groundwater remediation. The cover would be sufficient for use as the final remedy for the source term. It fully reduces risk to current and future workers under an industrial land use scenario to less than  $1 \times 10^{-6}$  and is consistent with the final remedy for the ABRP. This alternative is consistent with United States Environmental



Protection Agency (USEPA) guidance and the NCP for sites that have relatively large volumes of waste with low levels of contamination and is an effective use of risk management principles. This soil cover is the final action for surface soil contamination at the ABRP.

The groundwater in the M-Area Aquifer (water table aquifer) has been contaminated by three volatile organic compounds (VOCs) which exceed their respective Maximum Contaminant Levels (MCLs) for drinking water as established in the Clean Water Act. These VOCs are trichloroethylene (TCE) (maximum detection is 859 µg/L, MCL is 5 µg/L), tetrachloroethylene (PCE)(maximum detection is 35 µg/L, MCL is 5 µg/L), and methylene chloride (maximum detection is 196 µg/L, MCL is 5 µg/L).

An interim action designed to reduce the concentration of VOCs in the groundwater was selected for the groundwater remediation, rather than a final action, due to uncertainties that exist in the groundwater remediation strategy that warrant additional evaluation. Uncertainties are associated with determining the impact to the deeper Lost Lake Aquifer, determining the potential for commingling with the downgradient Miscellaneous Chemical Basin Operable Unit (MCB) plume and the upgradient A/M Area plume, and site-specific remedial technology efficiencies.

The groundwater remediation will be operated in two stages. In the first stage, 10 active air sparging wells will be installed in the >500 µg/L VOC plume and operated for approximately 12 months. Each sparging well will be surrounded with three BaroBall™ passive extraction wells to vent VOCs to the atmosphere. During this time, operating data and effectiveness monitoring data will be gathered to determine the suitability of this system for remediating the plume. Nutrient injection to stimulate bioremediation may also be evaluated to determine its effectiveness.

Stage 2 of the remediation would incorporate the operating and effectiveness data obtained from Stage 1 to design a more extensive system to address the >100 µg/L VOC plume. Stage 2 will also operate for approximately 12 months. The extraction method (passive soil vapor extraction (PSVE) and/or soil vapor extraction (SVE)) will be selected

based on performance results of Stage 1. Performance evaluation reports will be submitted to South Carolina Department of Health and Environmental Control (SCDHEC) and USEPA at the conclusion of each stage of the groundwater interim action. A final action will then be proposed in the final SB/PP for the ABRP based on the effectiveness of the interim action and data gathered during operation. The groundwater interim action is compatible with any anticipated final groundwater remedial actions at ABRP.

Concurrent with Stage 1 of the interim action, SRS will investigate potential additional waste site areas located within the ABRP OU. Recently available aerial photographs from the 1950's through the 1980's have revealed the potential presence of a "trench/pit" within the eastern end of and underneath the current A-Area Ash Pile (788-2A), an active facility. In addition, a "ditch" appears to extend from the northern end of the "trench/pit" to the east toward the power line road. However, further interpretation is difficult without confirmation by ground penetrating radar and subsurface investigation. Upon confirmation as waste site areas, the "trench/pit" and "ditch" would be managed as part of the ABRP OU.

The ABRP is located within the Upper Three Runs Watershed. The overall site strategy is to evaluate all of the OUs within this watershed to determine impacts, if any, to the associated streams and wetlands. SRS will manage all OUs to prevent impact to the Upper Three Runs Watershed. Upon disposition of all OUs within this watershed, a final comprehensive Record of Decision (ROD) for the watershed will be pursued.

Based on the ABRP RFI/RI/BRA (WSRC 1997a), the ABRP poses significant risk to human health. There were no ecological risks identified for the unit.

#### ***Statutory Determination***

This interim action is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action (unless justified by a waiver), and is cost-effective. Although this interim action is not intended to fully address the statutory mandate for permanence and treatment

to the maximum extent practicable, this interim action utilizes treatment and thus is in furtherance of that statutory mandate. Because this action does not constitute the final remedy for the ABRP, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action. Subsequent actions are planned to address fully the threats posed by the conditions at this OU.

Because this remedy will result in hazardous substances remaining onsite above levels that allow for unlimited use and unrestricted exposure, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within five years after commencement of the remedial action. Because this is an interim ROD, review of this OU and of this remedy will be continuing as United States Department of Energy (USDOE) continues to develop remedial alternatives for the ABRP.

An applicable or relevant and appropriate requirement (ARAR) waiver under §300.430(f)(1)(ii)(C) of the NCP for all groundwater constituents of concern (COCs) has been invoked because the selected remedy is an interim action measure that will become part of a total remedial action that will ultimately attain ARARs.

Per the USEPA-Region IV Land Use Controls (LUC) Policy, a LUC Assurance Plan (LUCAP) for SRS has been approved by the regulators. In addition, a LUC Implementation Plan (LUCIP) for the ABRP will be developed and submitted to the regulators for their approval with the post-IROD documentation. The LUCIP will detail how SRS will implement, maintain, and monitor the land use control elements of the ABRP preferred soil alternative to ensure that the remedy remains protective of human health and the environment.

In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the

management and disposal of waste. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility if contamination will remain at the unit.

The deed shall also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or the residual contamination no longer poses an unacceptable risk under residential use. Any reevaluation of the need for deed restrictions will be done through an amended ROD with USEPA and SCDHEC review and approval.

In addition, if the site is ever transferred to nonfederal ownership, a survey plat of the OU will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

#### ***Data Certification Checklist***

This IROD provides the following information

- COCs and their respective concentrations
- Baseline risk represented by the COCs
- Cleanup levels established for the COCs and the basis for the levels
- Current and future land and groundwater use assumptions used in the BRA and IROD
- Land and groundwater use that will be available at the site as a result of the selected remedy
- Estimated capital, operation and maintenance, and total present worth cost; discount rate; and the number of years over which the remedy cost estimates are projected
- Decision factor(s) that led to selecting the remedy (i.e., describe how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria)
- How source materials constituting principal threats are addressed

5/15/00  
Date

Thomas F. Heenan  
Thomas F. Heenan  
Assistant Manager for Environmental Programs  
U.S. Department of Energy, Savannah River Operations Office

8/2/00  
Date

Richard D. Green  
Richard D. Green  
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Waste Management Division  
U.S. Environmental Protection Agency - Region IV

11/12/00  
Date

R. Lewis Shaw  
R. Lewis Shaw  
Deputy Commissioner  
Environmental Quality Control  
South Carolina Department of Health and Environmental  
Control

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**DECISION SUMMARY  
REMEDIAL ALTERNATIVE SELECTION (U)**

**A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) Operable Unit**

**WSRC-RP-2000-4001  
Revision. 1  
April 2000**

**Savannah River Site  
Aiken, South Carolina**

**Prepared by:**

**Westinghouse Savannah River Company, LLC  
for the  
U. S. Department of Energy Under Contract DE-AC09-96SR18500  
Savannah River Operations Office  
Aiken, South Carolina**

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## **ACRONYMS**

ABRP	A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) Operable Unit
A/M	Administrative and Manufacturing
ARAR	Applicable or Relevant and Appropriate Requirement
BAP	benzo(a)pyrene
BRA	Baseline Risk Assessment
CAB	Citizens Advisory Board
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CMCOC	contaminant migration constituent of concern
CMS/FFS	Corrective Measures Study/Focused Feasibility Study
COC	constituent of concern
CPT	cone penetrometer technology
CSM	conceptual site model
DOT	United States Department of Transportation
DQO	data quality objective
ERA	ecological risk assessment
ESD	Explanation of Significant Difference
FFA	Federal Facility Agreement
ft/yr	feet per year
GPR	ground penetrating radar
HI	hazard index
HSWA	Hazardous and Solid Waste Amendments
IAPP	Interim Action Proposed Plan
ICMI/RAIP	Interim Corrective Measures Implementation/Remedial Action Implementation Plan
IRAO	interim remedial action objective
IROD	Interim Record of Decision
LUC	Land Use Controls
LUCIP	Land Use Controls Implementation Plan
LUCAP	Land Use Controls Assurance Plan
MCB	Miscellaneous Chemical Basin/Metals Burning Pit (731-4A/5A) Operable Unit
MCL	Maximum Contaminant Level
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Protection Act
NESHAP	National Emission Standards for Hazardous Air Pollutants

NPL	National Priorities List
OSHA	Occupational Safety and Health Administration
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCE	tetrachloroethylene
pCi/L	picocuries/liter
PSVE	passive soil vapor extraction
PTSM	principal threat source material
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RG	remedial goal
RGO	remedial goal option
RI	Remedial Investigation
ROD	Record of Decision
RP	rubble pit
SB/PP	Statement of Basis/Proposed Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SESOIL	SEasonal SOIL compartment model
SRS	Savannah River Site
SVE	soil vapor extraction (active)
TCE	trichloroethylene
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WSRC, LLC	Westinghouse Savannah River Company, Limited Liability Company

**I. SAVANNAH RIVER SITE AND OPERABLE UNIT NAME, LOCATION,  
AND DESCRIPTION**

**Site Name, Location, and Brief Description**

A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) Operable Unit

Comprehensive Environmental Response, Compensation, and Liability  
Information System (CERCLIS) Identification Number: OU-19

Savannah River Site

Comprehensive Environmental Response, Compensation and Liability Act  
(CERCLA) Identification Number: SC1890008989

Aiken, South Carolina

United States Department of Energy (USDOE)

Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is located approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina.

The USDOE owns SRS, which historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are byproducts of nuclear material production processes. Hazardous substances, as defined by the CERCLA, are currently present in the environment at SRS.

The Federal Facility Agreement (FFA) (FFA 1993) for SRS lists the A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) Operable Unit (OU)(ABRP) as a Resource Conservation and Recovery Act/Comprehensive Environmental Response, Compensation and Liability Act (RCRA/CERCLA) unit requiring further evaluation. The ABRP required further evaluation through

an investigation process that integrates and combines the RCRA Facility Investigation (RFI) process with the CERCLA remedial investigation (RI) process to determine the actual or potential impact to human health and the environment.

## **II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY**

### **SRS Operational and Compliance History**

The primary mission of SRS has been to produce tritium, plutonium-239, and other special nuclear materials for our nation's defense programs. Production of nuclear materials for the defense program was discontinued in 1988. SRS has provided nuclear materials for the space program, as well as for medical, industrial, and research efforts up to the present. Chemical and radioactive wastes are byproducts of nuclear material production processes. These wastes have been treated, stored, and in some cases, disposed of at SRS. Past disposal practices have resulted in soil and groundwater contamination.

Hazardous waste materials handled at SRS are managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities require South Carolina Department of Health and Environmental Control (SCDHEC) operating or post-closure permits under RCRA. SRS received a RCRA hazardous waste permit from SCDHEC, which was most recently renewed on September 5, 1995. Module IV of the Hazardous and Solid Waste Amendments (HSWA) portion of the RCRA permit mandates corrective action requirements for non-regulated solid waste management units subject to RCRA 3004(u).

On December 21, 1989, SRS was included on the National Priorities List (NPL). The inclusion created a need to integrate the established RFI Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA 42 USC Section 9620, USDOE has

negotiated an FFA (FFA 1993) with United States Environmental Protection Agency (USEPA) and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements. USDOE functions as the lead agency for remedial activities at SRS, with concurrence by the USEPA – Region IV and the SCDHEC.

### **Operable Unit Operational and Compliance History**

The ABRP comprises a RCRA/CERCLA waste unit located within SRS, approximately 1.5 miles south of M Area and just west of Road D (Figure 1). The Pits Area [the Pits Area shall refer to the two Burning/Rubble Pits (731-A/1A) and the Rubble Pit (731-2A) throughout this document] is surrounded by gravel access roads and a mix of relatively flat grassy and wooded terrain (Figure 2). An open ditch and ephemeral drain are located north and east, respectively, of the ABRP.

An additional pit (referred to as the Potential Pit within this document) has been tentatively identified approximately 500 feet east of the Pits Area (Figure 3). The Potential Pit was identified based on physical evidence (depression and subsidence) along the ground surface and interviews with SRS personnel. Ground penetrating radar (GPR) results suggest the presence of a trench boundary; however, further interpretation is difficult since soil has been disturbed over the entire area. Figure 3 also shows the topography and soil sample locations for ABRP taken during the original investigation (See Section V).

A depressional area (referred to as the Depressional Area within this document) is also located approximately 300 feet east of the Potential Pit.

Two additional features (Figure 2) are noted in close proximity to the ABRP, but are not a part of the OU: A-Area Ash Pile and two material storage areas. The A-Area Ash Pile (788-2A) is an active unit located immediately to the east of the

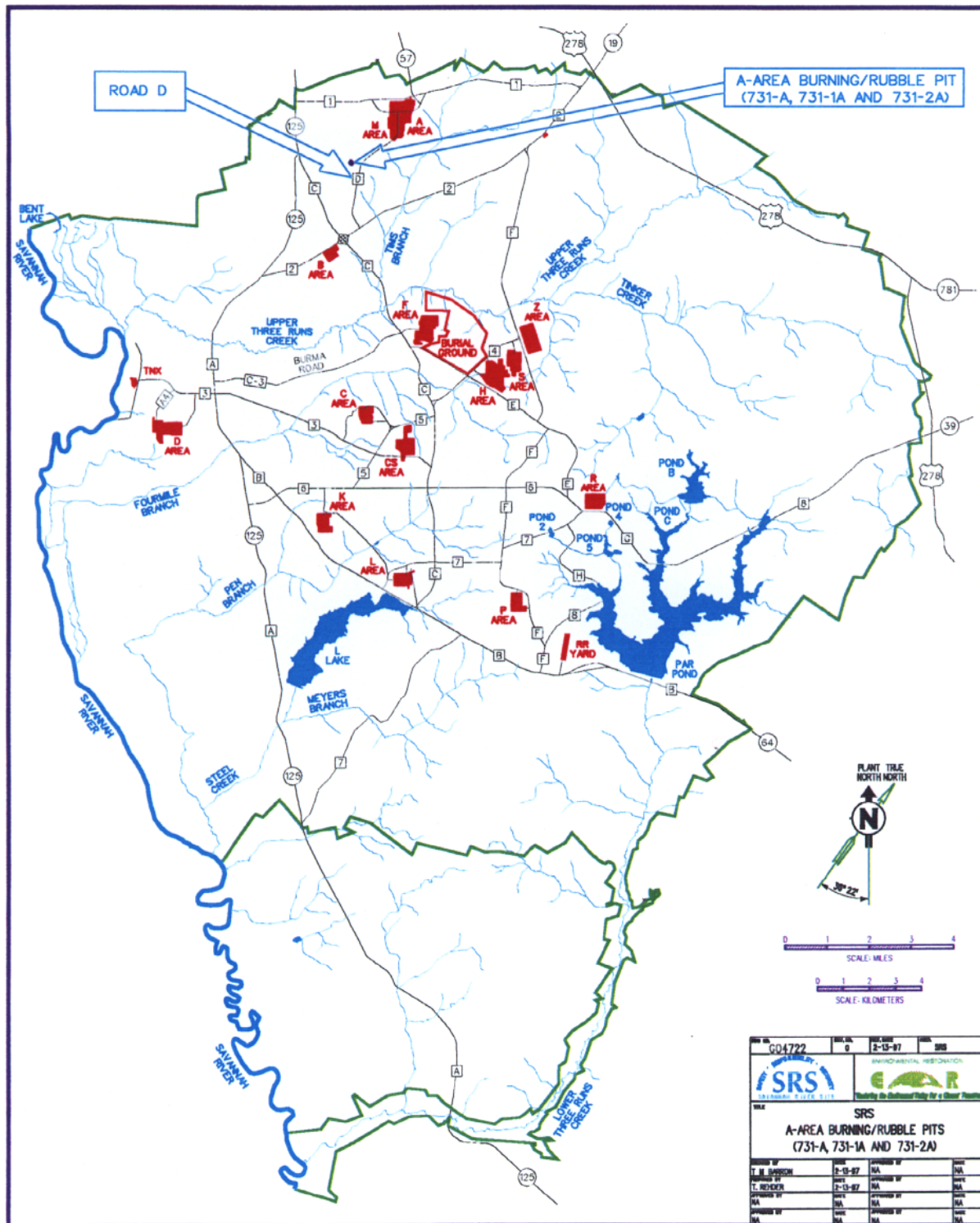


Figure 1. Location of the Savannah River Site and Major SRS Facilities



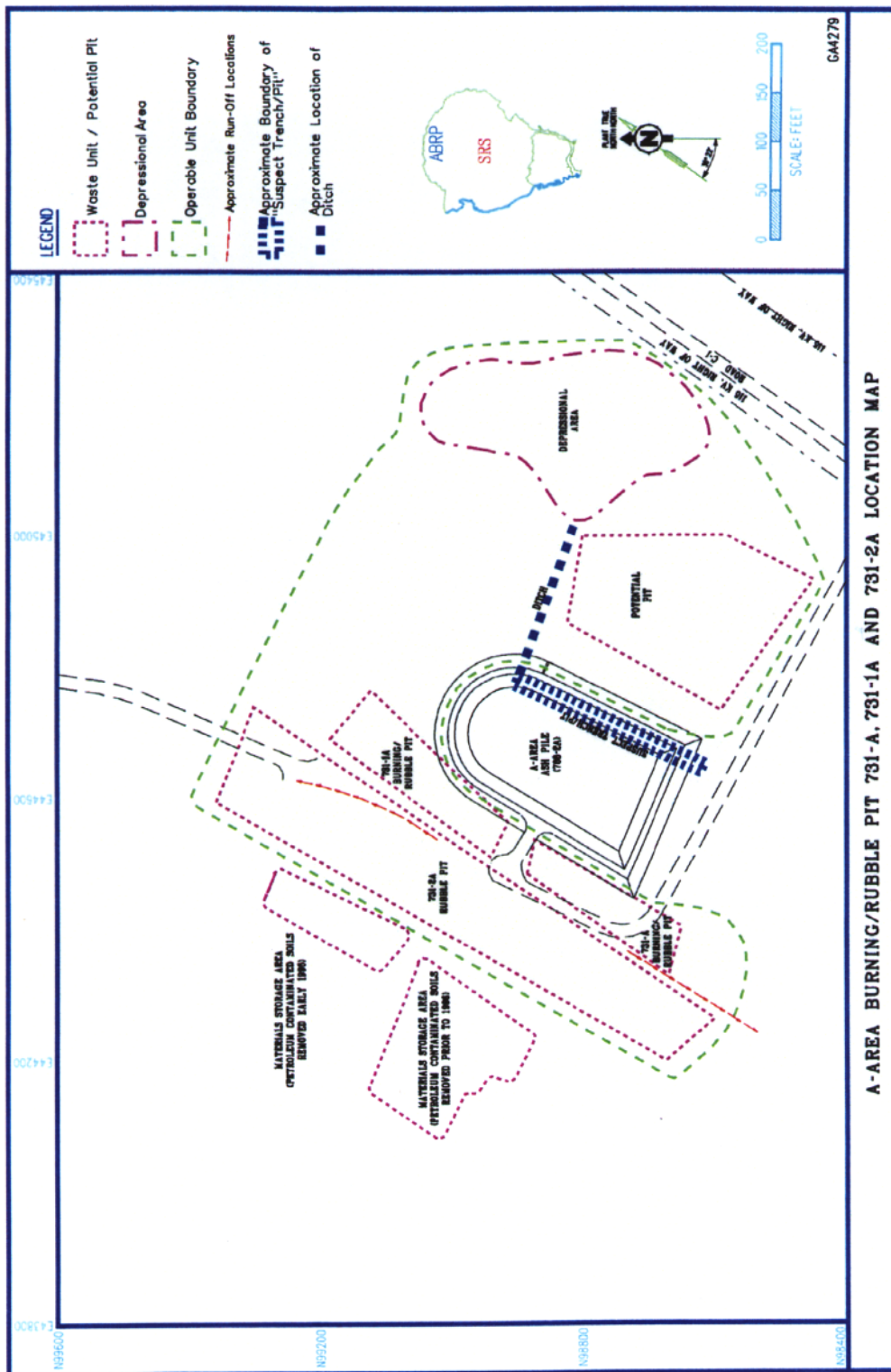


Figure 2. A-Area Burning/Rubble Pits (731-A, 731-1A) and Rubble Pit (731-2A) Location Map



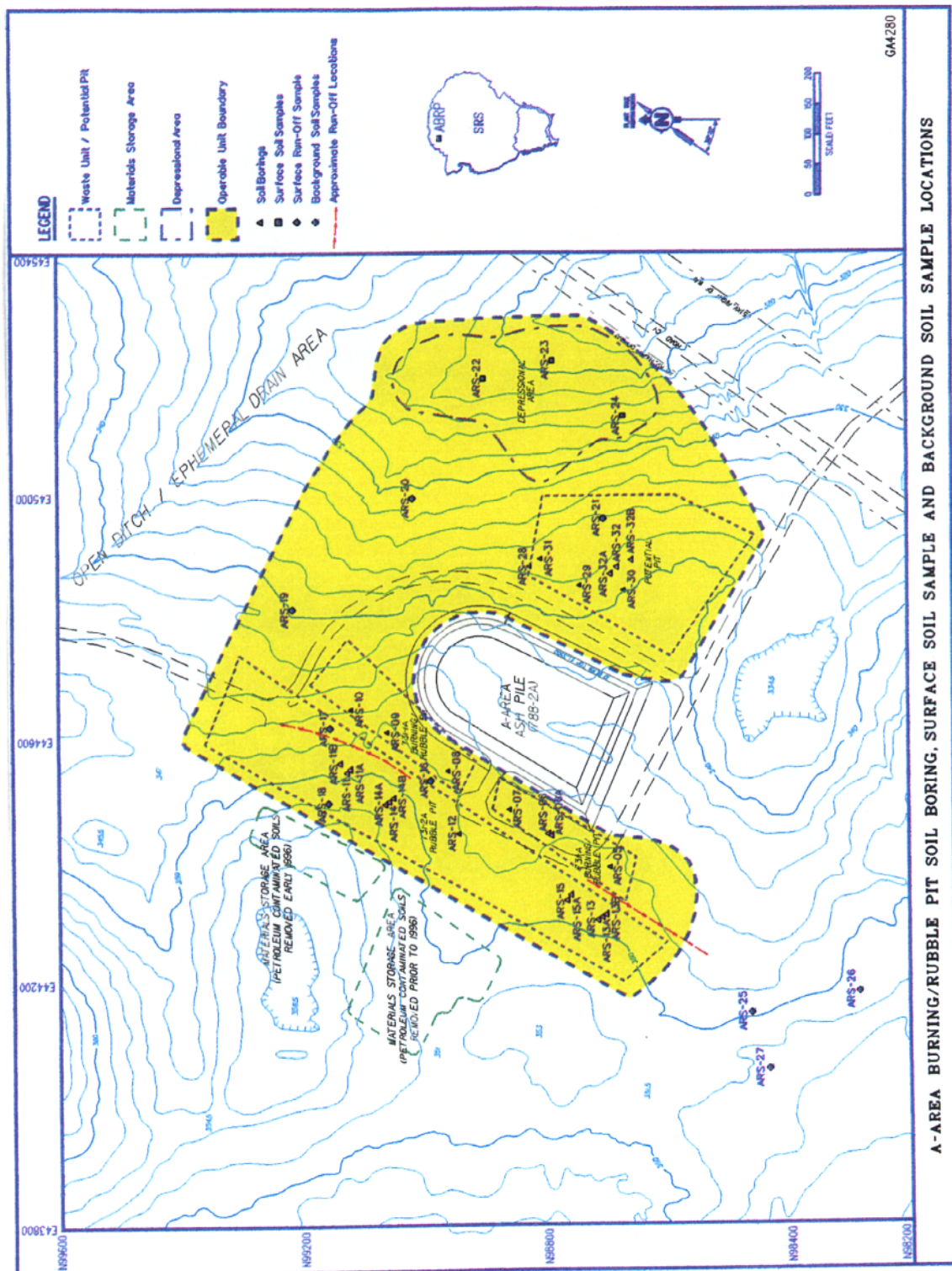


Figure 3. A-Area Burning/Rubble Pits Soil Boring, Surface Soil Sample, and Background Soil Sample Locations

Pits Area. The unit is currently included on the Site Evaluation List (Appendix G-1 of the FFA) for future assessment.

Recently available aerial photographs from the 1950's through the 1980's have revealed the potential presence of a "trench/pit" within the eastern end of and underneath the current A-Area Ash Pile (788-2A), an active facility (Figure 2). In addition, a "ditch" appears to extend from the northern end of the "trench/pit" to the east toward the power line road. However, further interpretation is difficult without confirmation by GPR and subsurface investigation. An investigation of these potential features is proposed concurrent with Stage 1 of the ABRP Interim Action.

The two material storage areas are situated to the west of the Pits Area. The areas were previously used to temporarily store petroleum-contaminated soil. During temporary storage, the soil was deposited on plastic sheets and covered with plastic sheets and tarps. Soils were removed in 1996 and dispositioned at either a Subtitle D landfill outside of SRS or at a thermal desorption facility outside of SRS, depending on analytical results.

Facility documentation indicates that the two Burning/Rubble Pits located in A Area were first constructed in 1951. GPR data show each burning/rubble pit to be approximately 22 feet wide, 9 to 10 feet deep, and 250 feet long. Waste types collected in the pits included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and drummed solvents. Wastes were usually burned on a monthly basis until October 1973, when burning was discontinued. A layer of soil was placed over the burned remains, and the pits were filled with paper, wood, concrete, empty galvanized steel barrels, and cans. The pits reached capacity around 1978 (no records available for the actual date) and were taken out of service and covered with soil to grade level.

Previous literature reviews suggested the Rubble Pit (731-2A) (RP) was located beneath the A-Area Ash Pile (788-2A). Furthermore, investigations conducted as part of the RFI/RI and BRA concluded that the RP was located west of the two burning/rubble pits based on GPR surveys discussed in the Work Plan (WSRC 1993). The depth of the RP is unknown but is suspected to be up to 20 feet. The areal dimensions of the pit are believed to be approximately 40 by 650 feet.

Recently available aerial photographs from the 1950's through the 1980's have revealed the potential presence of a "trench/pit" within the eastern end of and underneath the current A-Area Ash Pile (788-2A), an active facility. This feature may, in fact, correspond to the previous literature reviews that indicated the presence of a pit beneath the A-Area Ash Pile. An investigation of this potential feature is proposed concurrent with Stage 1 of the ABRP Interim Action.

No specific disposal records are known to exist for the RP; however, SRS rubble pits were used to dispose of dry, inert rubble such as concrete, metal, brick, tile, asphalt, high density plastics, glass, rubber products, wood products, and non-returnable empty drums. No radioactive or hazardous materials were reported to have been disposed of at the unit. After the last use of the RP in 1983, the area was backfilled and seeded.

No specific disposal records or historical use information is available for the Potential Pit or the Depressional Area.

The RI performed for the ABRP, which considered available historical information, indicates that soil and groundwater have been contaminated at the unit.

As previously stated, the ABRP is listed in the FFA as a RCRA/CERCLA unit requiring further evaluation to determine the actual or potential impact to human health and the environment. The RFI/RI Work Plan, Revision 1, was submitted to USEPA and SCDHEC on August 31, 1992. The RI field start began on June 28,

1994. The results of the RFI/RI/Baseline Risk Assessment (BRA) were presented in the *RCRA Facility Investigation/Remedial Investigation/Baseline Risk Assessment for the A-Area Burning Rubble Pits and Rubble Pit* (WSRC 1997a). The RFI/RI/BRA Report and the Corrective Measures Study/Focused Feasibility Study (CMS/FFS) were submitted in accordance with the FFA and the approved implementation schedule. The RFI/RI/BRA was approved by USEPA in May 1997 and SCDHEC in July 1997. USEPA and SCDHEC approved the CMS/FFS on September 9, 1997. An interim action is proposed to allow an early start of remedial activities focused on the volatile organic compound (VOC) "hot spot" cleanup in the groundwater plume, while generating additional data on the nature and extent of the groundwater interactions between the ABRP, the Miscellaneous Chemical Basin OU (MCB), and the A/M Area (Administrative and Manufacturing). These data will aid in determination of the final groundwater remedy.

An Interim Action Proposed Plan (IAPP) (WSRC 1996b) was submitted in accordance with the FFA and the approved implementation schedule and was approved by USEPA and SCDHEC on December 6, 1999.

### **III. HIGHLIGHTS OF COMMUNITY PARTICIPATION**

CERCLA requires that the public be given an opportunity to review and comment on the proposed remedial alternative. Public participation requirements are listed in Sections 113 and 117 of CERCLA 42 USC Sections 9613 and 9617. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the ABRP soils and groundwater. The Administrative Record File must be established at or near the facility at issue.

The SRS Public Involvement Plan (USDOE 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the

selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act, 1969 (NEPA). Section 117(a) of CERCLA, as amended, requires the notice of any proposed remedial action and provides the public an opportunity to participate in the selection of the remedial action. The *Interim Action Proposed Plan for the A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) Operable Unit* (WSRC 1996b), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the ABRP.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the following locations:

U. S. Department of Energy  
Public Reading Room  
Gregg-Graniteville Library  
University of South Carolina-Aiken  
171 University Parkway  
Aiken, South Carolina 29801  
(803) 641-3465

Thomas Cooper Library  
Government Documents Department  
University of South Carolina  
Columbia, South Carolina 29208  
(803) 777-4866

An SRS RCRA permit modification is not required at this time since this is an interim action. However, the final permit modification will (1) include the final selection of remedial alternatives under RCRA, (2) be sought for the entire ABRP with the final Statement of Basis/Proposed Plan (SB/PP), and (3) will include the necessary public involvement and regulatory approvals. This Interim Record of Decision (IROD) also satisfies the RCRA requirements for an Interim Measures Work Plan.

The public was notified of the public comment period through mailings of the *SRS Environmental Bulletin*, a newsletter sent to citizens in South Carolina and Georgia, and through notices in the *Aiken Standard*, the *Allendale Citizen Leader*, the *Augusta Chronicle*, the *Barnwell People-Sentinel*, and *The State* newspapers. The public comment period was also announced on local radio stations.

The IAPP 30-day public comment period began on December 21, 1999, and ended on January 19, 2000. The IAPP was presented to the SRS Citizens Advisory Board (CAB) Environmental Restoration and Waste Management Subcommittee in an open public meeting on January 11, 2000. A Responsiveness Summary, prepared to address any comments received during the public comment period, is provided in Appendix A of this IROD.

#### **IV. SCOPE AND ROLE OF THE OPERABLE UNIT WITHIN THE SITE STRATEGY**

##### **RCRA/CERCLA Programs at SRS**

RCRA/CERCLA units (including the ABRP) at SRS are subject to a multi-stage RI process that integrates the requirements of RCRA and CERCLA as outlined in the FFA (FFA 1993). The RCRA/CERCLA processes are summarized below

- investigation and characterization of potentially impacted environmental media (such as soil, groundwater, and surface water) comprising the waste unit and surrounding areas
- evaluation of risk to human health and the local ecological community
- screening of possible remedial actions to identify the selected technology which will protect human health and the environment
- implementation of the selected alternative

- documentation that the remediation has been performed competently
- evaluation of the effectiveness of the technology

The steps of this process are iterative in nature and include decision points which require concurrence between USDOE as owner/manager, USEPA and SCDHEC as regulatory oversight agencies, and the public (see Figure 4).

### **Operable Unit Remedial Strategy**

#### ***Upper Three Runs Interim Remedial Strategy***

The RFI/RI process provides a method of managing the steps to ultimate remediation of a specific waste unit. It is often preferable to group waste unit components and actions to expedite characterization and remediation components that pose the most significant risks. These groupings are typically designated as OUs.

It is the intent of the USDOE, USEPA, and SCDHEC to manage these OUs to minimize impact to the watershed. To effectively manage the impact to the Upper Three Runs Watershed (groundwater, streams, and wetlands), a comprehensive characterization plan for the waste units in the vicinity of the ABRP was developed. This characterization and regulatory process plan provides a programmatic method of promoting continuous characterization, risk assessment, remedial assessment, and remedial action.

The ABRP comprises a potential source control and groundwater OU located within the Upper Three Runs Watershed. The term “source control” for the ABRP applies to control of the contaminated soil that may act as a source of future contamination to groundwater through leaching. Source control and groundwater OUs within this watershed will be evaluated to determine impacts, if

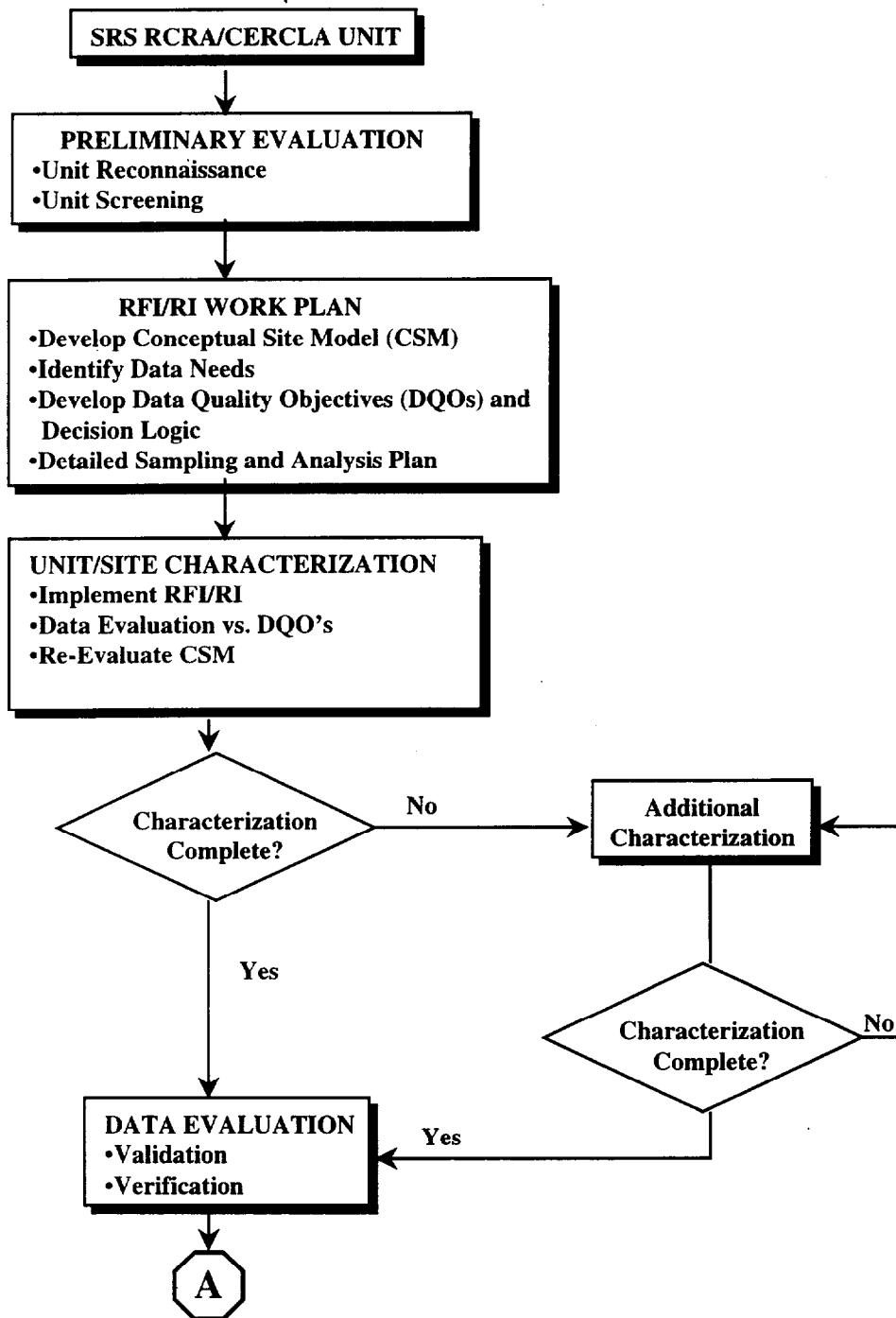


Figure 4. RCRA/CERCLA Logic and Documentation



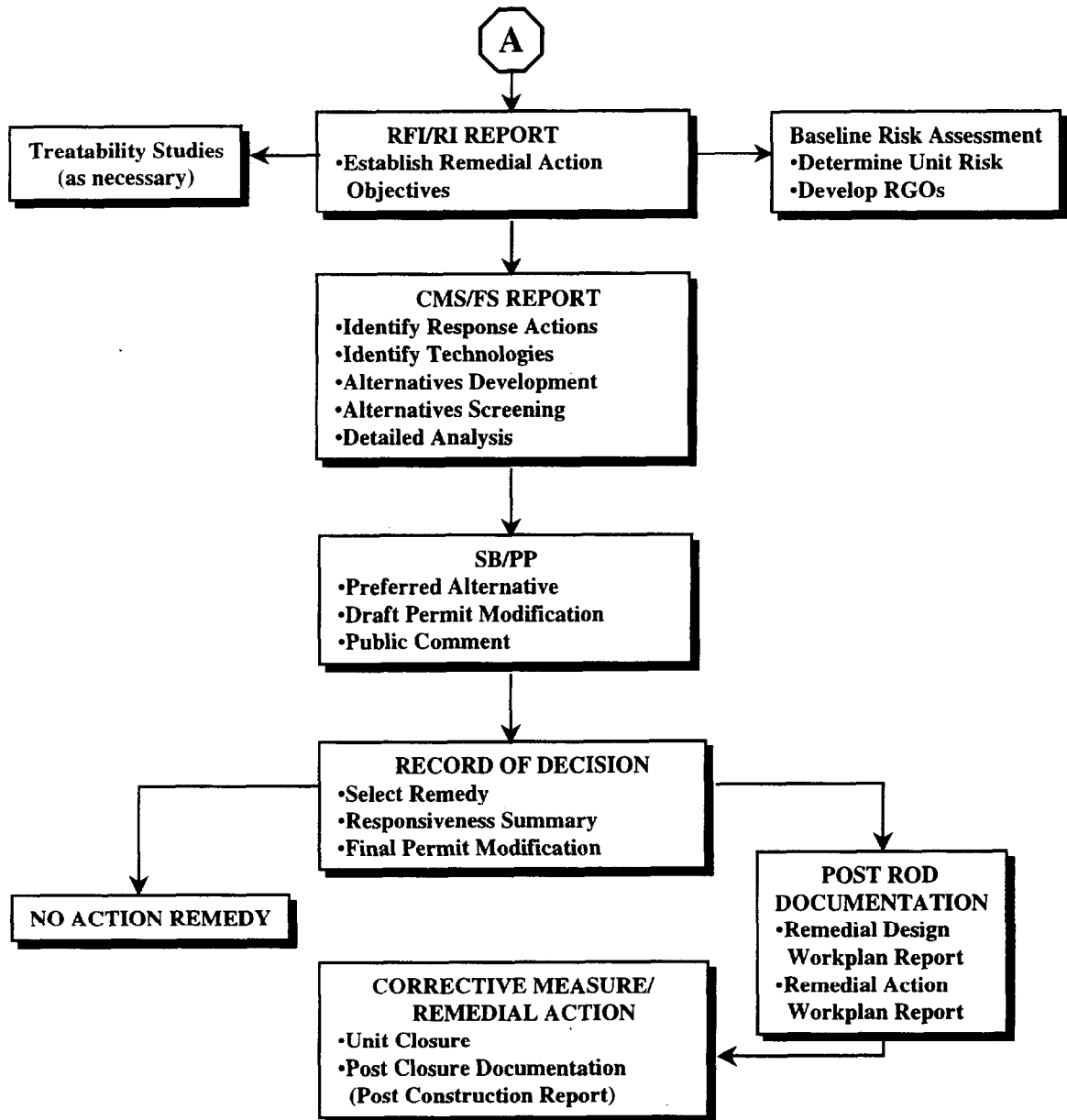


Figure 4. RCRA/CERCLA Logic and Documentation (continued)

any, to associated streams and wetlands. SRS will manage all source control units to prevent impact to the Upper Three Runs Watershed.

The overall strategy for addressing the ABRP is to perform a final action to address the benzo(a)pyrene (BAP) in the surface soil at Pit 731-2A and perform an interim action to reduce the concentration of VOCs in the groundwater. While the groundwater is being treated, additional information will be gathered that will be used to formulate the final remedy for the groundwater.

An interim action is proposed at the ABRP for groundwater remediation due to uncertainty in the extent of VOC contamination and due to the uncertainty involved in operating any in situ groundwater remediation process.

Groundwater sampling in the area has confirmed that the ABRP has contributed VOC contamination (as shown in Figures 12-16) to the M-Area Aquifer (water table aquifer). The same contaminants have been found upgradient and downgradient of the OU (as shown in Figure 17) in the deeper Lost Lake Aquifer; however, it is not known if the ABRP is or has contributed to contamination of the Lost Lake Aquifer. A much larger VOC-contaminated groundwater plume is located upgradient from the ABRP. This plume is associated with the M-Area Hazardous Waste Management Facility RCRA unit. This plume is moving in the general direction of the ABRP, and it is not clear whether these plumes have commingled. Remediation of VOC contamination associated with the A/M Area plume is in progress. The RCRA/CERCLA MCB is located downgradient of the ABRP. This facility also has a VOC-contaminated plume associated with it. A treatability study utilizing passive soil vapor extraction (PSVE) is in progress at the MCB. Additional remedial efforts are being pursued for the MCB through final actions for the soil and vadose zone and interim actions for groundwater at the unit. Further investigation is needed to determine if there is any interaction between the ABRP plume and either the A/M Area plume or the MCB plume.

Air sparging is a proven technology for removing VOCs from contaminated groundwater; however, site-specific conditions can greatly affect the effectiveness of this technology. An interim action will allow evaluation of the technology under actual operating conditions. Optimization of the process, design parameters, operating conditions, and effectiveness can be measured during the interim action that will greatly assist in designing the final remedy. The interim remedy is, therefore, recommended as a method to effectively treat the most contaminated portion of the VOC groundwater plume while providing information that will assure a definitive final remedy.

During the interim action, information will be gathered concerning the suitability of air sparging with PSVE as a final remedy, the extent of the contaminant plume, and whether upgradient plumes have commingled with the ABRP contaminant plume. This information will be used to prepare a CMS/FFS, a final SB/PP, and a final ROD for ABRP.

There is no principal threat source material (PTSM) at the ABRP. However, additional sampling at the OU (WSRC 1999a) indicated that the potential isolated locations ("hot spots") of BAP contamination in the surface soil at Pit 731-2A were more prevalent than previous data indicated during the RI (WSRC 1997a), but pose only a low level threat. A proposed one-foot thick soil cover over Pit 731-2A, combined with institutional controls, is consistent with USEPA guidance and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) for sites that have a relatively large volume of waste with relatively low levels of contamination and is an effective use of risk management principles.

## **V. OPERABLE UNIT CHARACTERISTICS**

### **Conceptual Site Model for the Operable Unit**

A conceptual site model (CSM) (Figure 5) was developed for the ABRP to identify primary sources, primary contaminated media, migration pathways, exposure pathways, and potential receptors for each of the two Burning/Rubble Pits (731-A/1A) and the Rubble Pit (731-2A), the Potential Pit/Depressional Area, surface water, and the groundwater. The CSM is based on the data presented in the RFI/RI/BRA (WSRC 1997a), which contains detailed analytical data for all of the environmental media samples taken in the characterization of the ABRP. This document is available in the Administrative Record File (see Section III).

Development of the CSM facilitates the initial step of determining the nature and extent of unit contamination through the identification of data gaps using the Data Quality Objective (DQO) process. DQOs are useful in identifying data needs associated with the sources and exposure media and in developing a sampling and analysis plan which describes the procedures for collecting sufficient data of known and defensible quality. The unit disposal and monitoring history indicated that the ABRP is a probable contamination source that may represent unacceptable risk to human health and the environment. In order to reduce that uncertainty associated with the nature and extent of contamination at the ABRP, contamination data needs were identified for the surface/subsurface soils and groundwater in the vicinity of the ABRP. Consequently, to make key remedial decisions it was necessary to perform a media assessment to obtain the required data.

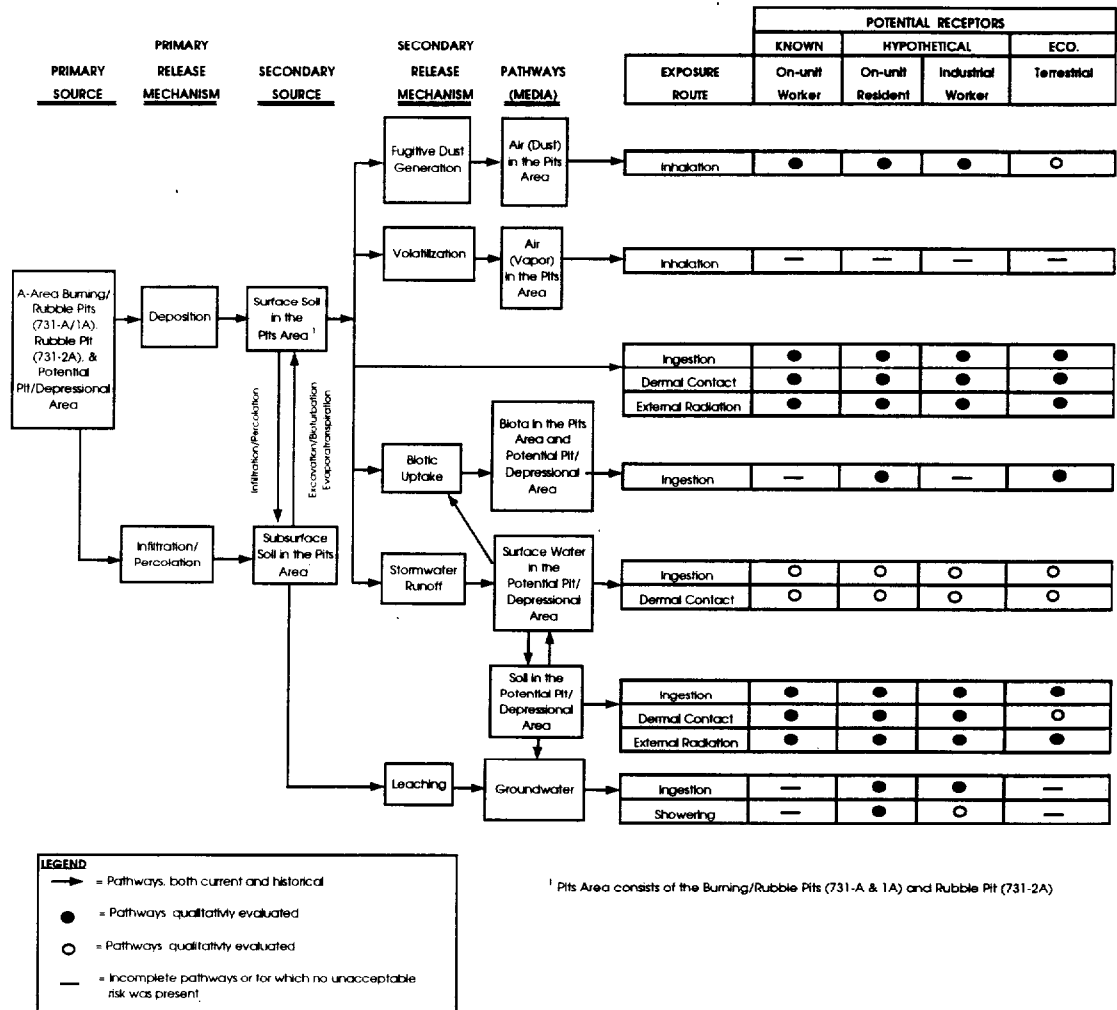


Figure 5. Conceptual Site Model for the ABRP

### **Media Assessment**

An RFI/RI Work Plan to acquire site characterization data was developed for the ABRP (WSRC 1993). The RFI/RI established unit-specific constituents to determine their distribution in source media associated with the unit. These characterization data provide the contaminant profile and mass information necessary to determine the potential for contaminant migration to off-unit receptors. For a more complete discussion of the characterization, see the RFI/RI/BRA (WSRC 1997a). A detailed sampling plan was prepared and implemented to investigate the secondary sources and groundwater. A complete description of the sampling methods and protocols is also provided in the RFI/RI/BRA. Soil-gas surveys of the ABRP were conducted in 1988 and again in 1991. A Phase One investigation of the three pits was also conducted in 1991. The physical and contaminant characteristic data was collected from May 1994 through March 1995. A GPR survey was made in March of 1994. Groundwater wells and piezometers were installed in August 1994 and data was obtained quarterly. An additional sampling event was made late in 1998 to evaluate soil and soil-gas in Pit 731-2A to better determine the extent of BAP contamination.

### ***Site Characteristics***

The RFI/RI/BRA (WSRC 1997a) and CMS/FFS (WSRC 1997b) contain detailed analytical data for all of the environmental media samples taken in the characterization of the ABRP. These documents are available in the Administrative Record File (see Section III).

Sampling results indicated that the surface soil (0-2 feet) in Pit 731-2A contained elevated levels of BAP above the remedial goal (RG) of 200 µg/kg. Groundwater samples showed levels of trichloroethylene (TCE), tetrachloroethylene (PCE), and methylene chloride above their respective maximum contaminant levels

(MCLs) of 5 µg/L. The following sections provide summaries of the soils, soil leachability, and groundwater assessments.

### **Soils**

The material placed in the three disposal pits (731-A, 731-1A, and 731-2A) is known from sampling and limited historical information and typically consists of debris (paper, lumber, cans, etc.) and industrial wastes (oil, degreasers, and solvents). Records of disposal are not available for the Potential Pit.

The only constituent of concern (COC) identified for the soil (incorporating the results of sampling at 731-A, 731-1A, 731-2A, the potential pit, and the depressional area, see Figure 6) is BAP in the surface soil (0-2 feet) of Pit 731-2A. This contaminant is widely dispersed with no discernible source. The maximum detection is 10,260 µg/kg.

Figure 6 shows the sampling grid used to obtain additional data for BAP soil contamination and soil-gas values during the 1998 sampling event (WSRC 1999a).

### **Soil Leachability**

Results from the leachability analysis indicate that none of the contaminants at ABRP will reach groundwater at concentrations that exceed their respective MCLs or pose a risk to human health or the environment within a 1,000-year period. Furthermore, the leachability results do not affect the engineering considerations of the proposed soil cover.

Modeling results, using the SEasonal SOIL (SESOIL) compartment model, indicate that among the radionuclide contaminant migration constituents of potential concern, only tritium has the potential to leach to the water table in a

1,000 year timeframe. Actual soil concentrations from ABRP sampling, in addition to site-specific and general (i.e., rainfall) input data, were utilized in the calculations and modeling. A detailed discussion of the modeling is in Section 5 of the approved RFI/RI/BRA Report (WSRC 1997a) for ABRP. The predicted maximum groundwater concentration of 1,774 pCi/L is consistent with the currently observed maximum groundwater concentration (1,930 pCi/L). This maximum level is less than 10% of the 20,000 pCi/L MCL for tritium. Therefore, tritium is not a contaminant migration constituent of concern (CMCOC) for soil leachability.

VOCs (TCE, PCE, and methylene chloride) were not detected in the unit soils at concentrations that exceed the site-specific soil screening levels, and therefore, TCE, PCE, and methylene chloride contamination in soil are not considered a continuing source to groundwater contamination. Hence, SESOIL modeling was not performed for TCE, PCE, and methylene chloride. TCE and PCE are not CMCOCs although both constituents have been observed in the M-Area Aquifer (water table aquifer) at concentrations of 859 µg/L and 35 µg/L respectively, which are much higher than their MCLs of 5 µg/L. The maximum concentration of methylene chloride (196 µg/L) (see Table 1) also exceeded the MCL of 5 µg/L. Based on the unit history and RFI/RI characterization data, it is believed that these VOCs have migrated through the subsurface soils and into the groundwater. As a result, TCE, PCE, and methylene chloride are unit-related COCs for groundwater (M-Area Aquifer) and are addressed in this IROD.

### **Groundwater**

Maximum levels of VOCs (specifically TCE) were detected at the ARP-5D well. The maximum concentration of methylene chloride was also detected at the ARP-5D well; however this maximum concentration of 196 µg/L was detected in the first round of sampling. This result had a laboratory flag attached because the



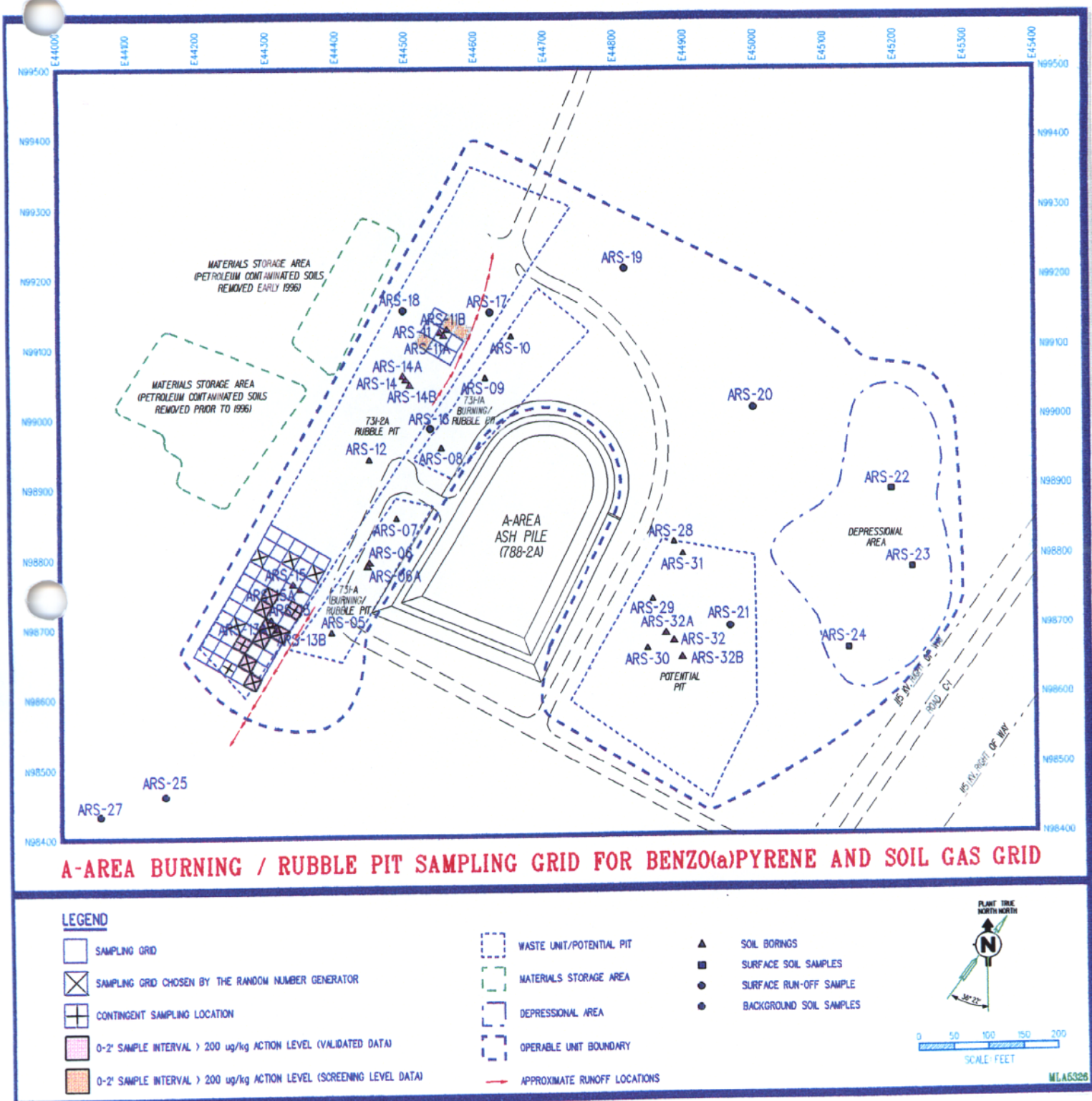


Figure 6. A-Area Burning/Rubble Pit Sampling Grid for Benzo(a)pyrene and Soil-gas Grid

same analyte was detected in the laboratory blank run in the batch in which this sample was analyzed. The second sampling event, which occurred one month later, had a non-detect for methylene chloride for the ARP-5D monitoring well. The next highest detection of methylene chloride occurred in the ARP-1A monitoring well with 20.3 µg/L in the November 1995 sampling event. The isopach map, Figure 14, uses December 1995 data.

Figure 7 shows the location of the sampling wells and piezometers. Figures 8 and 9 show hydrostratigraphic cross sections of the ABRP. Figure 10 is a potentiometric surface map for the M-Area Aquifer Zone and depicts approximate groundwater flow direction for both the M-Area Aquifer and the deeper Lost Lake Aquifer. It is estimated that 252,800 cubic feet of groundwater (2,105,824 gallons) have been contaminated with VOCs at levels that exceed the MCLs.

ABRP is located downgradient to an area of known groundwater VOC contamination in the Lost Lake Aquifer (see Figure 17). To ascertain the contribution of the known groundwater contamination in the Lost Lake Aquifer at the ABRP from A/M Area versus the contribution from ABRP proper, the interim action proposes the installation of several monitoring wells with completions in the Lost Lake Aquifer. Because of the location of the known upgradient contamination (A/M Area) within the Lost Lake Aquifer itself, it will be possible to determine if any contamination of the Lost Lake Aquifer has occurred from VOCs migrating through the M-Area Aquifer at ABRP. This interim action will facilitate the further investigation of the Lost Lake Aquifer and the possible commingling of the A/M Area VOC plume (in the Lost Lake Aquifer) with the ABRP VOC plume (in the Water Table Aquifer). Should the ABRP VOC plume prove to be contributing to the Lost Lake Aquifer contamination, remediation for the MCB downgradient of the ABRP may be impacted.

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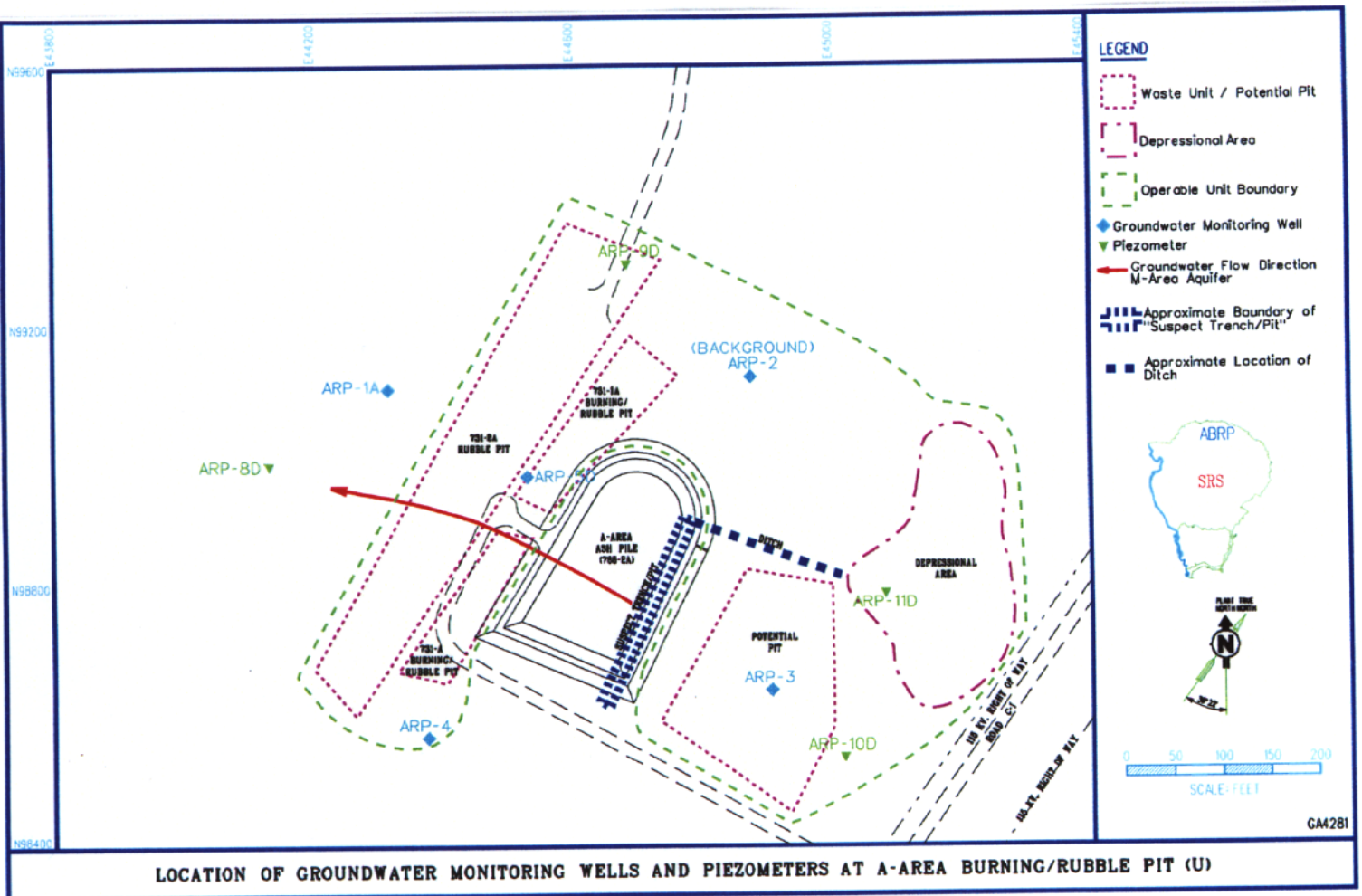


Figure 7. Location of the Groundwater Monitoring Wells and Piezometers at A-Area Burning/Rubble Pit



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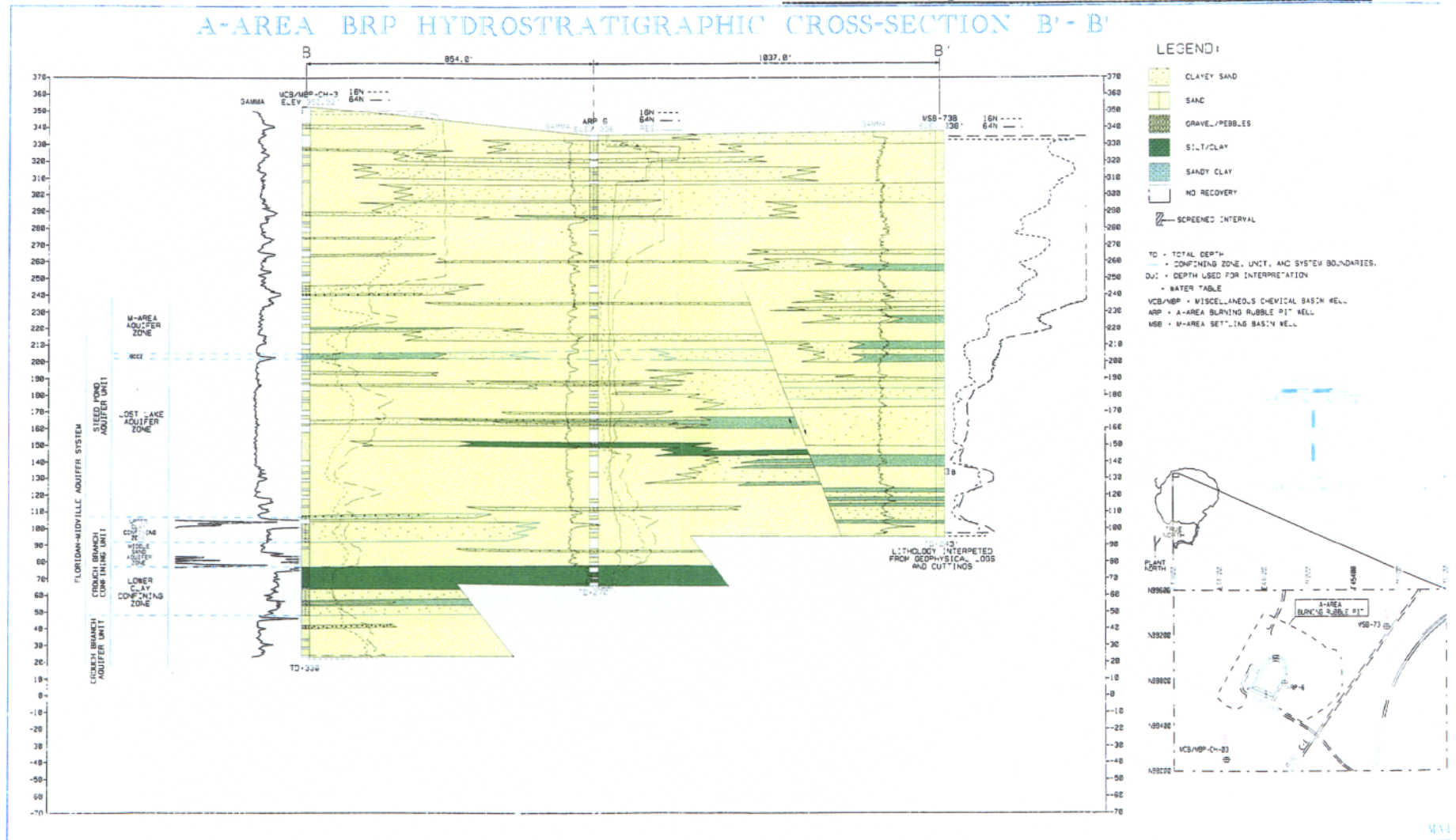


Figure 9. ABRP Hydrostratigraphic Cross Section B-B'





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### **Principal Threat Source Material**

Part of the analysis in the RFI/RI/BRA (WSRC 1997a) was to determine whether the ABRP contains PTSM or low level threat wastes. Both BAP in Pit 731-2A and VOCs in the soils and vadose zone were evaluated as potential PTSM. The risk to current or future industrial workers for the maximum BAP contamination ( $10,260 \mu\text{g/kg}$ ) found at the ABRP is  $6 \times 10^{-5}$ . This is well below the  $1 \times 10^{-3}$  risk level generally recognized to determine PTSM. Furthermore, there was no discernible source of BAP that could be removed.

It was also determined that the concentrations of VOCs in the soil are below levels that could result in a risk of  $1 \times 10^{-3}$  if contact was made with a human receptor. Because the risk levels are so low, the constituents are not considered PTSM.

The other test for PTSM is whether the material is mobile and present at concentrations that can act as a source of contamination to groundwater resulting in exceedences of MCLs or risk-based levels. Earlier in this document it was concluded that the level of VOCs in the soil is too low to meet this criterion.

A contaminant migration analysis performed in the RFI/RI/BRA demonstrated that the polycyclic aromatic hydrocarbons (PAHs) (including BAP) in the soil samples are not mobile. Results from the leachability analysis indicate that the PAHs will not reach groundwater at concentrations that pose a risk to human health or the environment within a 1,000 year period. Therefore, the ABRP does not contain any PTSM. Based on the immobility of BAP and the maximum concentrations near levels that allow for unlimited use and unrestricted exposure, BAP is considered to be a low level threat waste.

### **Contaminant Transport Analysis**

As mentioned above, the RFI/RI/BRA demonstrated that the PAHs in the soil are not mobile. VOCs were not detected in the unit soils at concentrations that exceed the site-specific soil screening levels, and therefore, TCE and PCE contamination in soil are not considered a continuing source of groundwater contamination.

The VOCs in the groundwater are located in the M-Area Aquifer (water table aquifer). Further investigation will be performed as part of the interim action to determine if the ABRP has contributed to the VOC contamination in the deeper Lost Lake Aquifer.

## **VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES**

### **Land Uses**

Current land use at the ABRP is industrial, although no workers are permanently located at this unit. The proximity of the ABRP to the A-Area Ash Pile, the two materials storage areas (temporarily stored petroleum-contaminated soil), and the A/M and B-Area industrial zones makes future industrial use the most likely scenario.

### **Groundwater/Surface Water Uses**

As shown in Figure 1, the headwaters of Tims Branch lie in the vicinity of the unit. Tims Branch is not currently used as a source of drinking water or for industrial applications and it is unlikely that Tims Branch will ever be used for these purposes. Surface water found at the ABRP is seasonal and occurs only after relatively heavy rains. Surface water is not a potential drinking water source or ecological wetland.



The groundwater in the western portion of A/M Area generally migrates toward the ABRP while the groundwater in the ABRP generally migrates toward the MCB. It is likely that these VOC-contaminated plumes will eventually commingle without remedial action.

## **VII. SUMMARY OF OPERABLE UNIT RISKS**

### **Baseline Risk Assessment**

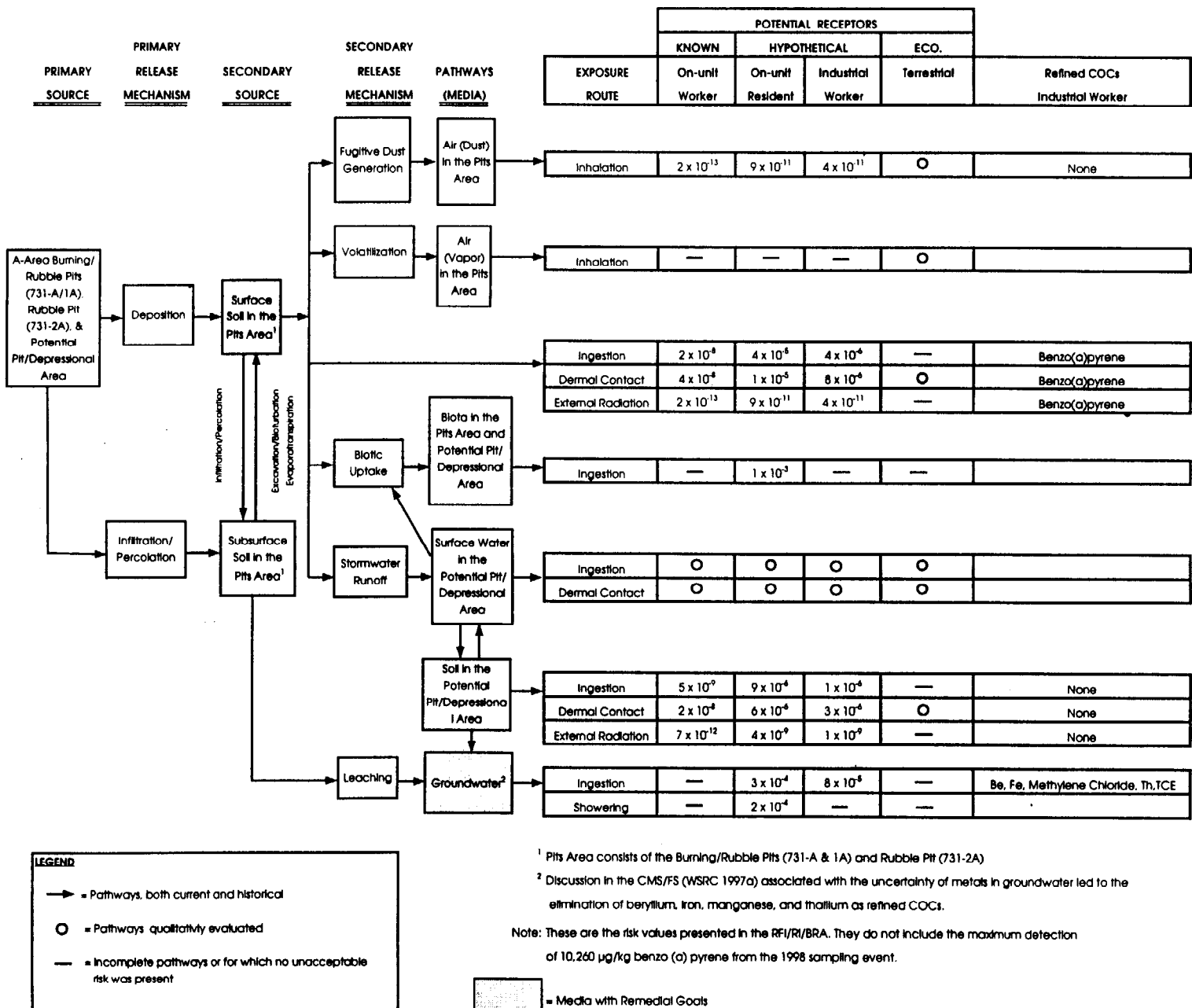
A BRA was conducted to assess the potential for adverse effects associated with exposure to contaminants present at the ABRP. The revised CSM for ABRP, shown in Figure 11, depicts the risk for each pathway and the COCs associated with the pathway. The CSM is used in risk calculations to identify the sources of contamination, the release mechanisms, the pathways, and the exposure routes for the potential receptors. Baseline risks are those present in the absence of any institutional controls or remedial actions for the unit. The BRA is used in the process of determining the need for remedial action because it provides a health-based or ecological justification for performing a remedial action to protect human health and the environment. This section of the IROD summarizes the results of the BRA for this OU. Detailed information regarding the risk assessment process can be found in the RFI/RI/BRA Report (WSRC 1997a).

### **Human Health Assessment**

Contaminant concentrations were determined for groundwater and soil. The data for each medium were sorted and grouped into data sets for either soil or groundwater to evaluate exposures in the risk assessment. There are background data for both soil and groundwater.

For soils, the data from the ABRP were divided into two exposure units: the Pits Area and the Potential Pit/Depressional Area. The soil from the 0 to 2 foot soil

Figure 11. Revised Conceptual Site Model for the ABRP



interval was used to assess exposures under both current (actual) and future conditions. The only soil COC was BAP in the surface soil of Pit 731-2A.

For the industrial worker, the chemical cancer risk is  $8 \times 10^{-5}$ , the radionuclide cancer risk is  $6 \times 10^{-6}$ , and the cumulative cancer risk for ingestion of groundwater is  $6 \times 10^{-5}$ . The chemical cancer risk for future residents is  $3 \times 10^{-4}$  for ingestion and  $2 \times 10^{-4}$  for showering. The radionuclide cancer risk for future residents is  $2 \times 10^{-5}$  for ingestion and  $2 \times 10^{-6}$  for showering. The cumulative cancer risk for future residents, including both groundwater ingestion and showering, is  $4 \times 10^{-4}$ . Both cesium-137 and tritium attributed to the radionuclide cancer risk for ingestion of groundwater; however, neither constituent exceeded their respective MCL and were not retained as refined COCs.

The level of BAP in the surface soil of Pit 731-2A poses a potential cancer risk to current and future workers and future hypothetical residents through dermal contact and ingestion. The maximum detection for BAP was 10,260  $\mu\text{g/kg}$ . This concentration calculates to a cumulative risk of  $6 \times 10^{-5}$  for current and future industrial workers.

### **Ecological Risk Assessment**

The purpose of the ecological risk assessment (ERA) component of the RFI/RI/BRA (WSRC 1997a) is to evaluate the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to unit-related contaminants based on a weight of evidence approach. An ecological risk does not exist unless a given contaminant has the ability to cause one or more adverse effects and it either co-occurs with, or is contacted by, an ecological receptor for a sufficient length of time, or at a sufficient intensity to elicit the identified adverse effect(s). For the ABRP, the ERA focused on soil, the only medium of ecological concern.

Mercury, the only final ecological COC identified in the RFI/RI/BRA, was reevaluated in the CMS/FS and the IAPP based on the latest available toxicity data for this constituent for the soil-dwelling biota assessment endpoint. The maximum detected mercury concentration at the Potential Pit/Depressional Area (1,130 µg/kg) is below the toxicity reference value of 5,000 µg/kg. Therefore, mercury was not retained as a final COC (Figure 11) and remediation for mercury is not warranted.

None of the contaminants found at the ABRP pose an ecological risk.

### **Summary of Contaminant Migration**

Modeling was performed to evaluate the potential for soil contaminants to leach to groundwater. Based on the modeling, no CMCOCs were identified.

### **Principal Threat Source Material**

No PTSM exists at ABRP. As discussed in Section V, BAP poses a low level threat only.

### **Conclusion**

In summary, the retained final COCs are

- BAP for surface soil in Pit 731-2A and
- TCE, PCE, and methylene chloride for groundwater.

Actual or threatened releases of hazardous substances from this unit (e.g., BAP in soil and VOCs in groundwater), if not addressed by implementing the response action selected in the IROD, may present a current or potential threat to public health, welfare, or the environment.

## **VIII. REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOALS**

### **Remedial Action Objectives**

Remedial action objectives (RAOs) specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. The RAOs are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure. Initially, preliminary remediation goals are developed based on applicable or relevant and appropriate requirements (ARARs) or other information from the RFI/RI Report and the BRA. These goals should be modified, as necessary, as more information concerning the unit and potential remedial technologies becomes available. Final remediation goals will be determined when the remedy is selected and shall establish acceptable exposure levels protective of human health and the environment.

ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal, state, or local environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Three types of ARARs (action-, chemical-, and location-specific) have been developed to simplify identification and compliance with environmental requirements. Action-specific requirements set controls on the design, performance, and other aspects of implementation of specific remedial activities. Chemical-specific requirements are media-specific concentration limits that allow for unlimited use and unrestricted exposure developed for site-specific levels of contaminants in specific media. If the level of a constituent in a given medium exceeds a federal or state chemical-specific ARAR, that constituent is also included as a COC (USEPA 1995). Location-specific ARARs must consider

federal, state, and local requirements that reflect the physiographical and environmental characteristics of the unit or the immediate area.

There were no action-specific, chemical-specific, or location-specific ARARs relevant to establishing RAOs for the ABRP soil.

For groundwater, action-specific ARARs include the Clean Air Act and South Carolina Well Standards and Regulations. Air permits and well installation permits must be obtained. Underground injection control permits will be required. The only chemical-specific ARARs for the ABRP are the MCLs for groundwater from the Clean Water Act. The MCL is 5 µg/L for all three VOCs (TCE, PCE, and methylene chloride).

The RAOs and RGs for ABRP soil and groundwater are listed in Table 1. A table of ARARs that were considered for the ABRP is shown in Appendix B.

### **Interim Remedial Action Objectives**

A number of uncertainties are associated with the groundwater remediation strategy and these warrant additional evaluation. These uncertainties are associated with determining the impact to the deeper Lost Lake Aquifer, determining the potential for the downgradient MCB plume to commingle with the upgradient A/M Area plume, and determining site-specific remedial technology efficiencies. Therefore, interim action is recommended for groundwater at the ABRP.

Based on the RFI/RI/BRA, interim remedial action objectives (IRAOs) for the ABRP can be identified (see Table 1). The IRAOs are specific early action goals developed to reduce risk to human health. IRAOs were not developed for surface soil because the preferred alternative is a final action. The IRAOs established for this IROD are addressed in the following sections:

**TABLE 1. SUMMARY OF THE REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOALS FOR SOIL AND GROUNDWATER**

Area/Media of Concern	Remedial Action Objectives	Potential Exposure Pathway	COCs	Interim Remedial Goal	Final Remedial Goal	Maximum Detection
Groundwater	<p><b>Interim</b> - 1) mitigate any further plume growth; 2) reduce concentration of the contaminant plume within the 100 µg/L VOC contaminated plume isopleth; 3) evaluate the effectiveness of the remedial system and its impact on the aquifer system; and 4) reduce the uncertainty of commingling of plumes between the two aquifer systems.</p> <p><b>Final</b> - Prevent exposure to contaminated groundwater above MCLs and restore groundwaters to their expected beneficial uses.</p>	Ingestion/ Inhalation	<p>TCE PCE Methylene Chloride</p> <p>TCE PCE Methylene Chloride</p>	<p>100 µg/L 100 µg/L 100 µg/L</p>	<p>5 µg/L 5 µg/L 5 µg/L</p>	<p>859 µg/L 35 µg/L 196 µg/L*</p>
Pits Area/ Surface Soil	<b>Final</b> - Prevent direct contact with and ingestion of BAP-contaminated surface soil which may cause a significant risk ( $>1 \times 10^{-6}$ or hazard index (HI) = 1) to current and future workers.	Direct Contact or Ingestion of soil	BAP	Not applicable	200 µg/kg	10,260 µg/kg

\*The 196 µg/L value for methylene chloride is suspect. This value from the first sampling event for ARP-5D was qualified with the note that the analyte occurred in the laboratory blank. In the second sampling event for ARP-5D, which occurred one month later, methylene chloride was not detected with a detection limit of 0.5 µg/L.

**Groundwater** – Treat the M-Area Aquifer (via two stages) to

- 1) mitigate any further plume growth;
- 2) reduce concentration of the contaminant plume within the 100 µg/L VOC contaminated plume isopleth;
- 3) evaluate the effectiveness of the remedial system and its impact on the aquifer system; and

- 4) reduce the uncertainty of commingling of plumes between the two aquifer systems.

This interim action at the ABRP targeting the M-Area Aquifer will not meet the groundwater MCL ARAR; however, the MCLs are ARARs for the final remedial action. This is consistent with the waiver provisions of 40 CFR §300.430(f)(1)(ii)(C)(1), which do not require an interim action alternative to meet an ARAR provided the alternative is an interim measure and will become part of a total remedial action that will attain the ARARs.

A principal initiative under the interim action will be to assess the potential for contaminants to have penetrated the Green Clay confining layer that separates the M-Area and Lost Lake Aquifers. As was suggested by the recent application of a regional groundwater model, the expectation is that the ABRP M-Area Aquifer plume would, in time, move to the deeper Lost Lake Aquifer. While the interim action will effect groundwater remediation for the known ABRP M-Area Aquifer plume, concurrent work will be undertaken to examine the status of the Lost Lake Aquifer for two significant conditions. First, the Lost Lake Aquifer will be investigated just downgradient of the ABRP. This data will address uncertainties regarding the downward movement of the ABRP VOC plume and its quantitative impact on the Lost Lake Aquifer. Second, the lower part of the Lost Lake Aquifer will be examined just upgradient of ABRP to monitor for the presence of the leading edge of the A/M Area VOC plume, known to be generally migrating toward ABRP.

Since the upgradient A/M Area plume is moving in the general direction of the ABRP, and the ABRP plume may be moving toward the further downgradient MCB plume, it is unclear whether these plumes represent a future VOC source relative to the MCB groundwater. The data gained from these investigations will be used to assess the impact of ABRP on the Lost Lake Aquifer as well as the



potential for the ABRP VOC plume to commingle with the A/M Area VOC plume and the MCB VOC plume. Further, the need for preemptive remedial activities in the Lost Lake Aquifer associated directly with the final ABRP remedy would be decided if it were found that the MCB and the A/M Area groundwater corrective actions would not be sufficient to handle the resultant plume. Interim action at the ABRP targeting the M-Area Aquifer will provide contaminant mass removal and control contaminant plume migration. Groundwater flow at ABRP in the M-Area Aquifer is to the west (see Figures 7, 10, and 18). Groundwater flow rates are estimated at approximately 80 ft/yr. Based on groundwater flow rates, the VOC plume ( $>100 \mu\text{g/L}$ ) is anticipated to migrate approximately 160 ft over the two-year interim action. Groundwater monitoring will be performed to verify groundwater plume geometry. This action will minimize the potential for plume growth in the M-Area Aquifer and migration to the deeper Lost Lake Aquifer. If the plumes are commingled, the action would be consistent with final RAOs established by the three Parties.

### **Final Remedial Action Objectives**

#### ***Surface Soil***

Based on the RFI/RI/BRA, final RAOs and RGs for the ABRP have been identified and are shown in Table 1. The only COC for surface soil is BAP for the Pits Area. The final RAO for surface soil is

- Prevent direct contact with and ingestion of BAP-contaminated surface soil which may present a significant risk ( $>1 \times 10^{-6}$  or hazard index [HI] = 1) to current and future workers.

The final remedial goal for BAP in surface soil ( $200 \mu\text{g/kg}$ ) was developed based on the assumption that the ABRP is designated for current and future industrial

use. There are no COCs that pose a threat to migrate to groundwater; therefore no RAO or RG is required for the vadose zone soil.

### ***Groundwater***

Groundwater COCs are TCE, PCE, and methylene chloride.

The final RAO for groundwater is

- Prevent exposure to contaminated groundwater above MCLs and restore groundwaters to their expected beneficial uses.

The final remedial goals for groundwater are tentatively set at the MCLs for the respective COCs. However, for any in situ groundwater treatment there is considerable uncertainty as to how well a specific remediation method will work at a given site. While the retained technologies have been shown to be effective at other sites, site-specific conditions relating to the soil conditions can greatly affect the actual effectiveness of a remedy. These uncertainties warrant additional evaluation during the interim action period with the objective of defining a remedy that, with a high degree of confidence, will achieve final remedial goals while being cost effective. For this reason, the interim groundwater remedial goals have been set at a level above the MCLs.

Ultimately, achieving the final remedial goals will reduce risk to acceptable levels for human health.

### **Ecological**

No specific remedial goal is necessary to reduce ecological risks to the environment because the ABRP does not pose a risk to the environment.

## **IX. DESCRIPTION OF ALTERNATIVES**

The ABRP poses risk to human health due to BAP in surface soils for current and future industrial land use. Groundwater beneath the ABRP has been contaminated with levels of VOCs in excess of MCLs. This contamination is attributable to past practices at the ABRP. Therefore, the soil and the groundwater require remediation.

The CMS/FFS (WSRC 1997b) included detailed analyses for four groundwater remediation alternatives. A fifth alternative (4/5GW), which is a hybrid of 4GW and 5GW, was added after the CMS/FFS. These alternatives were

- (1GW) No Action;
- (2GW) Institutional Controls, Monitoring,
- (4GW) Active Air Sparging with Active Soil Vapor Extraction, Carbon Adsorption for Offgas Treatment, Monitoring;
- (5GW) Active Air Sparging with PSVE (BaroBall™ wells) and Enhanced Biodegradation, Carbon Adsorption for Offgas Treatment, Monitoring; and
- (4/5GW) Active Air Sparging with Staged Active/PSVE and Enhanced Biodegradation, Carbon Adsorption for Offgas Treatment, Monitoring.

The three soil remediation alternatives in the CMS/FFS were

- (1S) No Action,
- (2S) Institutional Controls, and
- (3S) Soil Extraction and Off-site Disposal with Institutional Controls).

Additional investigative data obtained since the CMS/FFS evaluation of alternatives compels the addition of Alternative 4S, Soil Cover over Pit 731-2A, with Institutional Controls. Detailed evaluation of this interim action alternative is provided in this document.

In the following discussion the soil alternatives are identified with an "S" and groundwater alternatives with "GW".

### **Remedy Components, Common Elements, and Distinguishing Features of Each Alternative**

#### ***Groundwater Alternatives***

##### **Alternative 1GW. No Action**

**Estimated Present Value Cost: \$8,346**

**Estimated Time to Implement: None**

##### **Major Remedy Components**

- None.

##### **Key ARARs Associated with this Remedy**

- 40 CFR 141 and SC R.61-58.5 - MCLs for contaminated groundwater

Under this alternative, no action would be taken at the ABRP to remediate the groundwater. USEPA policy and regulations require consideration of a No Action alternative to serve as a basis against which other alternatives can be compared. Because no further action would be taken, the groundwater beneath the ABRP would remain in its present condition. There would be no reduction or mitigation of risk. IROD reviews would be provided every five years because the

No Action alternative would not reduce the level of VOCs in the groundwater to below their respective MCLs.

**Alternative 2GW. Institutional Controls, Monitoring**

**Estimated Present Value Cost: \$167,916**

**Estimated Operating Time: 30 years**

**Major Remedy Components**

- Land Use Controls (LUCs) would be used to prevent the installation of drinking water wells. Groundwater monitoring would be provided until the groundwater meets the MCLs.

**Key ARARs Associated with this Remedy**

- 40 CFR 141 and SC R.61-58.5 - MCLs for contaminated groundwater

Under this alternative, institutional controls would be implemented at the ABRP. Implementation of this alternative will require both short- and long-term actions. For the short term, signs will be posted indicating that this area was used to manage hazardous materials. In addition, existing SRS access controls will be used to maintain the site for industrial use only.

Per the USEPA-Region IV LUC Policy, a LUC Assurance Plan (LUCAP) for SRS has been approved by the regulators. In accordance with the LUCAP, a LUC Implementation Plan (LUCIP) for the ABRP will be developed and submitted to the regulators for their approval with the post-IROD documentation. The LUCIP will detail how SRS will implement, maintain, and monitor the LUC elements of the ABRP preferred alternative to ensure that the remedy remains protective of human health and the environment.

IROD reviews would be provided every five years because the interim action is not expected to reduce the level of VOCs in the groundwater to below their respective MCLs.

Risks to hypothetical future workers from ingestion of groundwater would be removed because workers would not be allowed to drink from the water table aquifer.

**Alternative 4GW. Active Air Sparging with Active Soil Vapor Extraction,  
Carbon Adsorption for Offgas Treatment, Monitoring**

**Estimated Present Value Cost: \$3,323,638**

**Estimated Operating Time: 2 years**

**Major Remedy Components**

- Ten active air sparging wells would be installed with up to thirty active soil vapor extraction (SVE) wells.
- An activated carbon offgas treatment system would be provided if the levels from the extraction wells exceeded the air permit levels.
- Groundwater monitoring would continue until the COCs were reduced to below MCLs.

**Key ARARs Associated with this Remedy**

- 40 CFR 141 and SC R.61-58.5 - MCLs for contaminated groundwater
- SC R.61-71 - Well Construction Standards

- 40 CFR 61 - National Emission Standards for Hazardous Air Pollutants (NESHAP)

Alternative 4GW is an active air sparging system with an active SVE system. It is assumed to have 10 air sparging wells and up to 30 vapor extraction wells. These wells are assumed to be drilled wells for costing purposes. Two separate piping networks would be used: one to provide air to the sparging wells and the other to tie the SVE wells together with a vacuum pump and a carbon adsorption unit. For cost estimating purposes, it is assumed the system would be operated for two years. Groundwater monitoring would be used to show that groundwater passing a compliance point will not exceed MCLs. IROD reviews would be provided every five years because the interim action is not expected to reduce the level of VOCs in the groundwater to below their respective MCLs.

**Alternative 5GW. Active Air Sparging with Passive Soil Vapor Extraction  
(BaroBall™ Wells) and Enhanced Biodegradation, Carbon  
Adsorption for Offgas Treatment, Monitoring**

**Estimated Present Value Cost: \$3,164,231**

**Estimated Operating Time: 5 years**

**Major Remedy Components**

- Forty active air sparging wells would be installed with up to thirty passive soil vapor extraction wells (BaroBall™ wells). The wells would be installed using cone penetrometer technology (CPT) whenever possible.
- A nutrient injection system (mobile trailer) may be used to enhance in situ bioremediation of the VOCs.

- An activated carbon offgas treatment system would be used if the emission levels exceeded the air permit levels.
- Groundwater monitoring would continue until the COCs were reduced to below MCLs.

*Key ARARs Associated with this Remedy*

- 40 CFR 141 and SC R.61-58.5 - MCLs for contaminated groundwater
- SC R.61-71 - Well Construction Standards
- 40 CFR 61 - NESHAP

Alternative 5GW utilizes active air sparging with PSVE using a series of BaroBall™ wells. The air sparging wells would also be equipped to allow the injection of methane and other nutrients for stimulating bioremediation. A total of 40 air sparging wells were included, each with three BaroBall™ vapor extraction wells. These wells would be installed using CPT, when possible, rather than drilling. It is assumed that the nutrient injection, if used, would only be performed occasionally for each well. Therefore, a blower, methane tank, nutrient injection tank, controls, etc. would be mounted on a trailer and moved periodically to service a different set of wells every few weeks. No piping was planned for the BaroBall™ wells. Small carbon adsorption units would be purchased if the level of VOCs leaving the BaroBall™ wells exceeded permit levels; however, the emissions are expected to be relatively low in this passive system. For cost estimating purposes, it is assumed the system would be operated for five years. Groundwater monitoring would be used to show that groundwater passing a compliance point does not exceed MCLs.



IROD reviews would be provided every five years because the interim action is not expected to reduce the level of VOCs in the groundwater to below their respective MCLs.

**Alternative 4/5GW, Active Air Sparging with Staged Active/Passive Soil**

**Vapor Extraction and Enhanced Biodegradation, Carbon  
Adsorption for Offgas Treatment, Monitoring**

**Estimated Present Value Cost: \$3,010,638 to \$4,221,228**

**Estimated Operating Time: 2 years**

**Major Remedy Components**

- Ten active air sparging wells would be installed initially (Stage 1) and operated for 12 months with thirty PSVE wells. The extraction wells would be installed using CPT whenever possible.
- Stage 2 of the remediation may use either active or passive extraction wells, depending on the success of the passive extraction wells in Stage 1 (first 12 months). Additional active air sparging wells will be added in Stage 2 to further enhance the remediation.
- A nutrient injection system (mobile trailer) may be used to enhance in situ bioremediation of the VOCs.
- An activated carbon offgas treatment system would be used if the emission levels exceeded the air permit levels.
- Groundwater monitoring would continue until the COCs were reduced to below MCLs.

*Key ARARs Associated with this Remedy*

- 40 CFR 141 and SC R.61-58.5 - MCLs for contaminated groundwater
- SC R.61-71 - Well Construction Standards
- 40 CFR 61 - NESHAP

Alternative 4/5GW is a hybrid of Alternatives 4GW and 5GW. Alternative 4GW utilizes active air sparging to strip VOCs from the groundwater and an active SVE system to remove the VOC vapors from the unsaturated soils above the groundwater to the atmosphere. Alternative 5GW also utilizes active air sparging, but removes VOC vapors using a PSVE system (e.g., BaroBall™ wells). Alternative 4/5GW will initially use a system of active air sparging wells with passive extraction wells (similar to 5GW) but may use active extraction wells in its second stage, if necessary. The optimum air sparging configuration for a specific site cannot be determined without actually operating a small system first to gather information concerning the radius of influence of the wells, the efficiency of the system, optimum air sparging levels, etc. Therefore, a staged approach (two stages) will be used in remediating the ABRP VOC plume.

In the first stage, 10 active air sparging wells, each with 3 BaroBall™ passive extraction wells (as presented in Alternative 5GW), will be installed and operated for approximately 12 months. During this time, operating data and effectiveness monitoring data will be gathered to determine the suitability of this system for remediating the plume. Nutrient injection to stimulate bioremediation may also be evaluated to determine its effectiveness. The second stage will provide additional active air sparging wells with either passive or active extraction wells. The number and type of wells will be determined using data from Stage 1.

The cost of this alternative is difficult to determine because the number and type of wells required for Stage 2 cannot be determined until results from Stage 1 are obtained and evaluated. Stage 1 is assumed to require 10 active injection wells, each with 3 passive BaroBall™ extraction wells. The capital costs for Stage 1 are calculated to be \$1,054,500. This is broken down at \$80,000 for 10 well systems (active air sparging well with 3 passive extraction wells); \$500,000 to prepare the area, add temporary roads, provide an electrical supply system, etc.; \$105,000 for piping, installation, mobile trailer, vehicle, etc. (this is one-fourth of the cost estimated for the 40 well systems of Alternative 5GW); \$9,000 for two blowers; and \$351,500 for engineering and overhead (assumed to be 50% of the capital costs).

The best case capital costs for Stage 2 are estimated to be \$832,500. This includes an additional 30 well systems (each active air sparging well would have 3 passive extraction wells associated with it) like Alternative 5GW; piping, installation, etc., costs of \$315,000; and engineering and overhead costs of \$277,500. The total capital costs for Stage 2 are \$1,887,000. Start-up costs are assumed to be \$153,600. Annual operating costs are assumed to be \$300,000 for two years. The present value operating cost is, therefore, \$571,770. The cost for preparing the post-IROD report is \$150,000. Shutdown is assumed to be \$100,000 after two years for a present value cost of \$90,700. Monitoring cost is expected to be \$10,000 per year for 30 years, giving a present value of \$157,568. The total present value cost for the best case 4/5GW Alternative is \$3,010,638.

The worst case capital cost for Stage 2 is estimated to be \$1,852,500. This includes 10 additional well systems with PSVE for \$80,000; 20 well systems (assumed to be drilled for costing purposes) with active extraction wells for \$800,000; \$315,000 for piping, installation, etc.; \$10,000 for a carbon adsorption system; \$10,000 for a methane injection system; \$20,000 for an injection system; and \$617,500 for engineering and overhead, for a total capital cost of \$1,852,500.

Start-up costs are estimated to be \$153,600 while annual operating costs are assumed to be \$400,000, giving a present value cost of \$762,360 for two years. The cost to prepare the post-IROD report is estimated to be \$150,000. Shutdown is assumed to be \$100,000 after two years, for a present value cost of \$90,700. Monitoring cost is expected to be \$10,000 per year for 30 years, giving a present value of \$157,568. The total worst case present value cost is estimated to be \$4,221,228.

IROD reviews would be provided every five years because the interim action is not expected to reduce the level of VOCs in the groundwater to below their respective MCLs.

### **Discussion of a Staged Approach**

Because restoration of an aquifer to achieve MCLs is uncertain, SRS plans to conduct a staged approach for groundwater remediation at the ABRP. The staged approach is designed to implement the basic system, evaluate the effectiveness of the remediation design and system components, and provide information necessary to design and implement additional remediation elements as necessary to reach RAOs. The remedial approach will be designed to reduce VOC concentrations and volume in a staged approach. Specific objectives for each stage of the remedial action are specified below:

Stage 1: Design and install air sparging wells with PSVE to initiate remediation in the VOC plume (See Figures 12 through 18). The conceptual configuration for the locations of the sparging wells in Figure 18 is based on the staged approach. Stage 1 locations focus on the >500 µg/L plume and Stage 2 locations will further address the >100 µg/L plume. Site-specific operational data collected from this stage will be used to evaluate the effectiveness of the remediation strategy and aid in the design of Stage 2. Evaluation will include, but not be limited to, air

sparging well zone of influence; PSVE zone of capture; effectiveness of air sparging wells to remediate contaminated groundwater and nutrient injection requirements. Enhanced bioremediation will be evaluated during Stage 1, based on the performance of the air sparging/passive soil vapor extraction system. Should the air sparging/passive soil vapor extraction system prove to have a significantly smaller zone of influence than anticipated (i.e., < 50% of a projected 15 foot radius of influence), enhanced bioremediation would be evaluated as an added remedial measure to compensate in part for the reduced effects of the engineered system. Stage 1 will operate for a period of approximately 12 months after initiation of the interim remedial action. At that time an evaluation of the process will be made and Stage 2 will be initiated. The wells installed in Stage 1 will continue to operate throughout Stage 2 as well.

Stage 2: Based on the performance evaluation of Stage 1, implement additional modifications (i.e., increase the number of sparging wells, etc.) to the system as necessary to complete remediation. Stage 2 will operate for a period of approximately 12 months after completion of system modifications.

Through staging the remedial action and using performance data from the early stage of remediation, SRS will optimize its ability to restore the aquifer to an acceptable condition. At the completion of each stage, SRS will evaluate the practicality of remediating the groundwater to below MCLs. Revised remediation goals will be proposed, as appropriate, based on the data collected during the interim action, in a CMS/FFS for the final ABRP groundwater remedy.

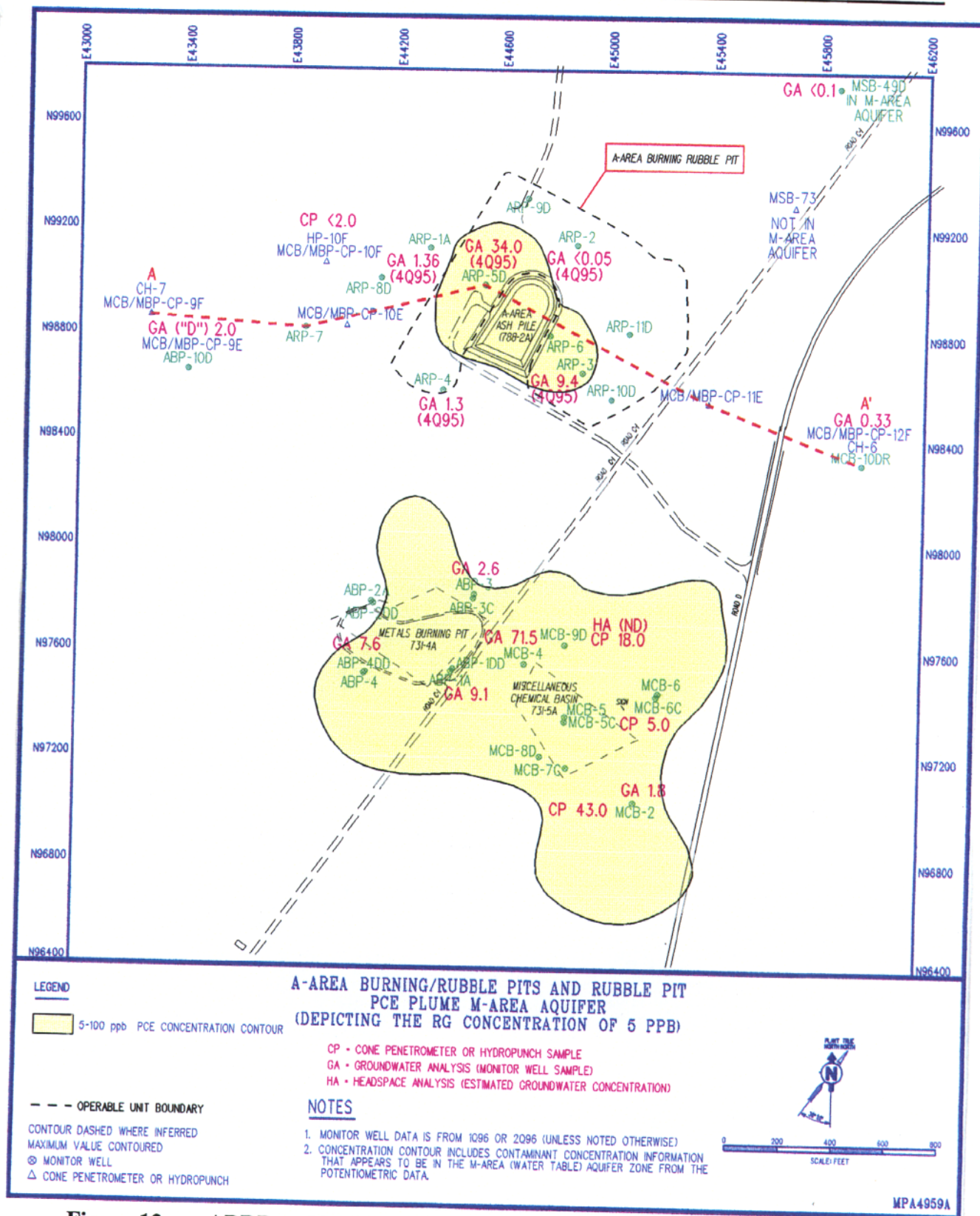


Figure 12. ABRP and MCB PCE Plume, M-Area Aquifer, Above 5 µg/L



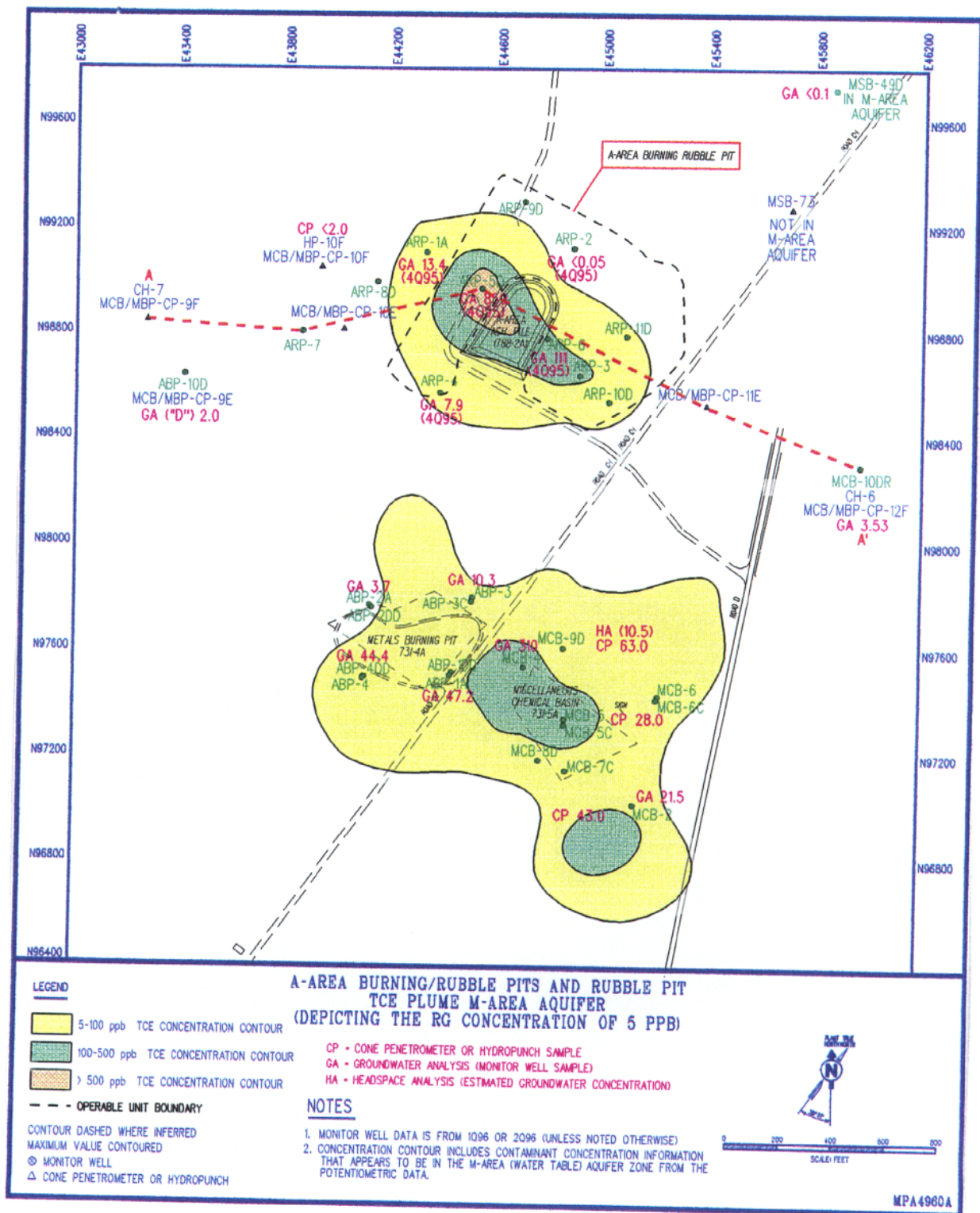


Figure 13. ABRP TCE Plume, M-Area Aquifer, Above the Final RG of 5 µg/L

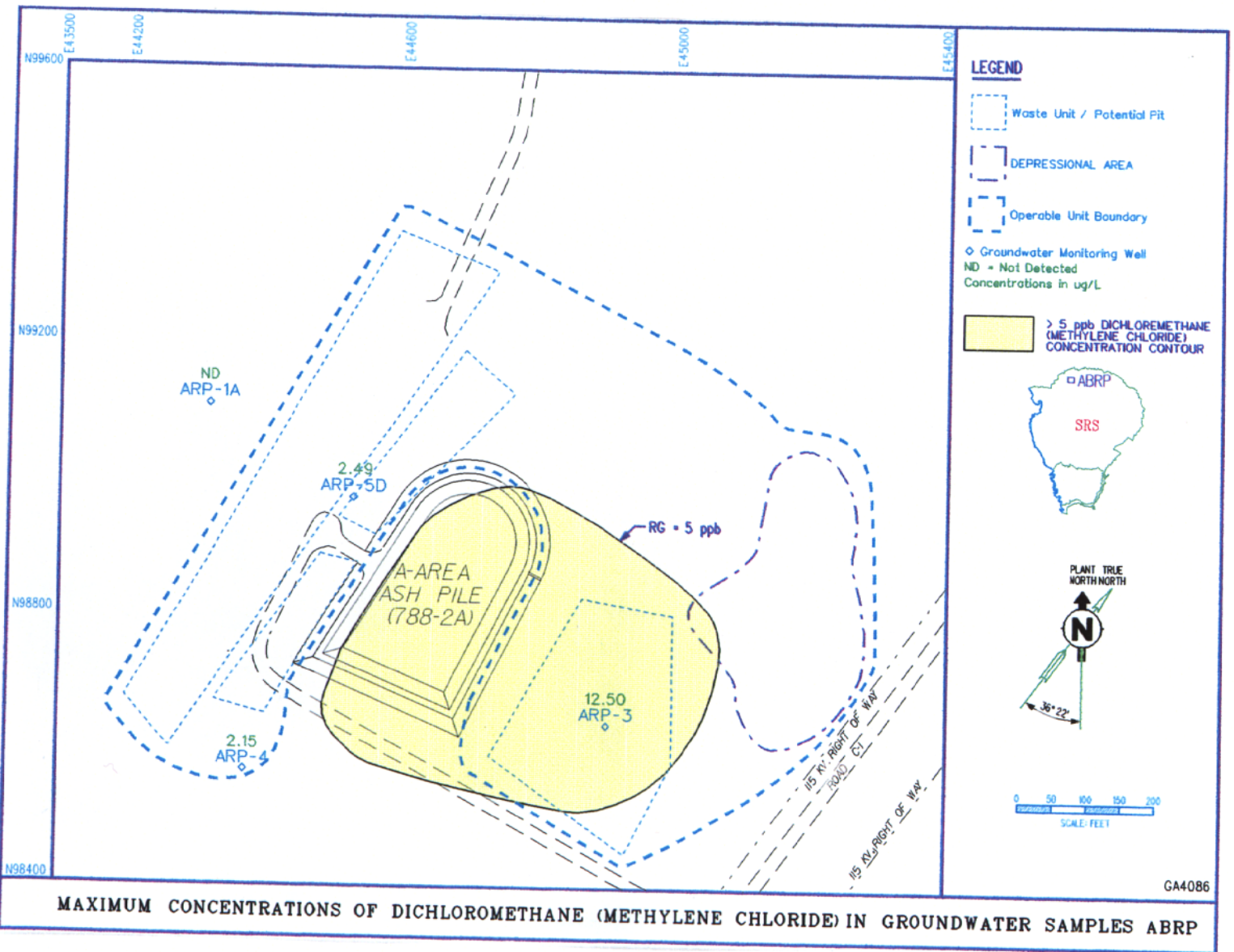
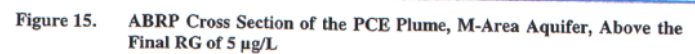


Figure 14. ABRP Methylene Chloride Plume, M-Area Aquifer, Above the Final RG of 5 µg/L

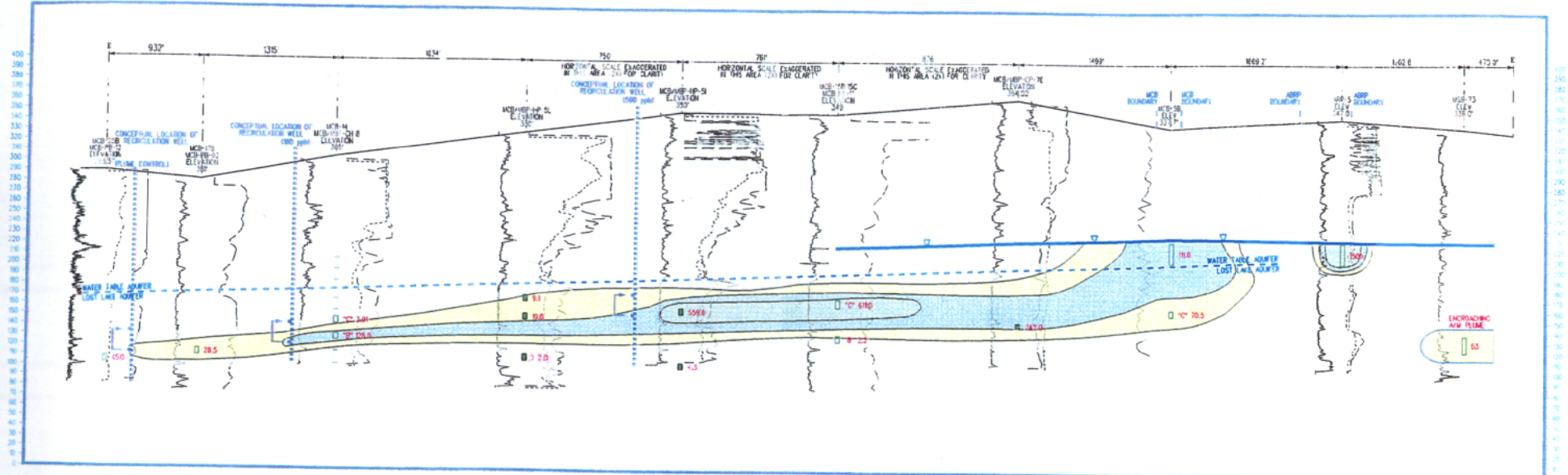




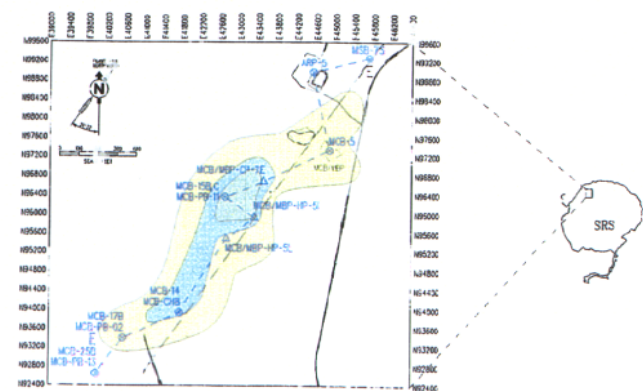
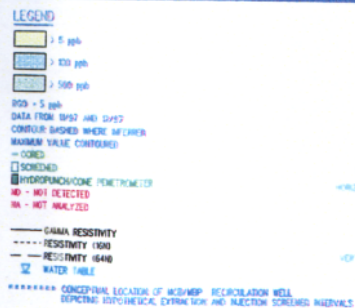


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A-Area Burning/Rubble Pits Miscellaneous Chemical Basin/Metals Burning Pit Cross Section E-E Trichloroethylene (TCE) Plume



**Figure 17. A-Area Burning/Rubble Pits/Miscellaneous Chemical Basin Cross Section E-E' Trichloroethylene (TCE) Plume**

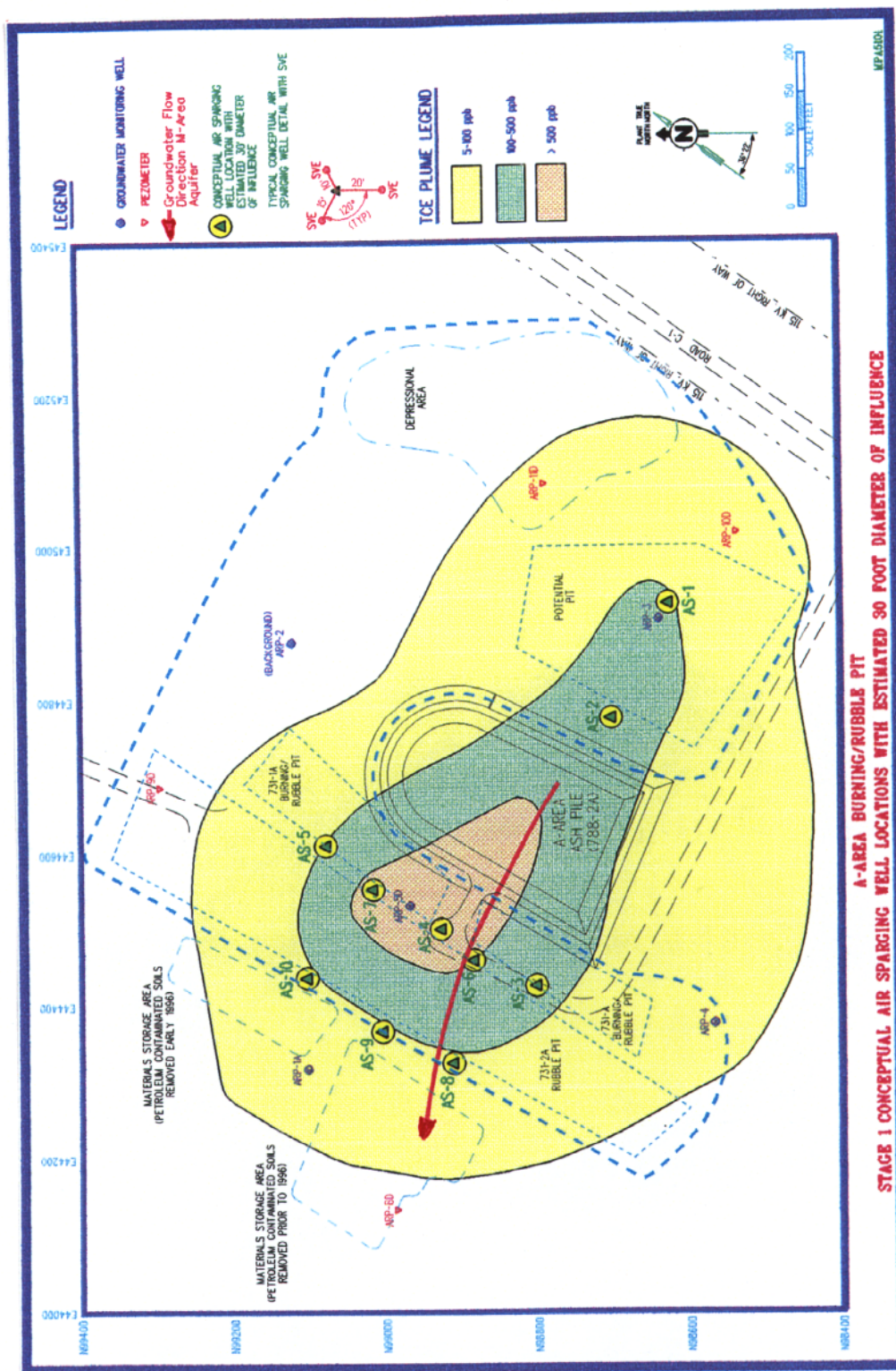


Figure 18. ABRP Stage 1 Conceptual Air Sparging Well Locations with Estimated 30-foot Diameter of Influence

*Soil Remediation Alternatives*

**Alternative 1S. No Action**

**Estimated Present Value Cost: \$8,346**

**Estimated Operating Time: None**

*Major Remedy Components*

- None

*Key ARARs Associated with this Remedy*

- None

Under this alternative, no action would be taken at the ABRP to remediate the soil. USEPA policy and regulations require consideration of a No Action alternative to serve as a basis against which other alternatives can be compared. Because no further action would be taken, the soil in the ABRP would remain in its present condition. There would be no reduction or mitigation of risk. If this alternative was selected, IROD reviews would be required every five years because waste is left in place.

**Alternative 2S. Institutional Controls**

**Estimated Present Value Cost: \$10,346**

**Estimated Operating Time: 30 years**

*Major Remedy Components*

- LUCs would be used to maintain future industrial land use for all of the subunits at the ABRP OU (Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A)).

*Key ARARs Associated with this Remedy*

- None

Current SRS access controls will limit any remediation worker access to the area to well below the duration used to calculate the future industrial worker risk (8 hours per day, five days per week, for 25 years). Groundwater remediation planned for this area will likely require at least five years of operation. Current SRS access controls will be suitable for restricting worker access (other than the groundwater remediation workers) to BAP contaminated soils.

For the short-term, signs would be posted indicating that this area was used to manage hazardous materials. In addition, existing SRS access controls would be used to maintain the use of this site for industrial use only.

IROD reviews would be provided every five years because waste is left in place.

In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government would take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. A survey plat would be prepared and filed with the local zoning authority. The deed notification would, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of non-hazardous, inert construction debris and that wastes containing hazardous substances, such as

degreasers and solvents, were also managed and burned on the site. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of the RCRA facility if contamination will remain at the site. The deed would also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions could be reevaluated at the time of transfer in the event that exposure assumptions differ and/or contamination no longer poses an unacceptable risk under residential use. Any reevaluation of the need for deed restrictions would be done through an amended ROD with USEPA and SCDHEC approval.

**Alternative 3S. Soil Extraction and Offsite Disposal with Institutional Controls**

**Estimated Present Value Cost: \$630,346**

**Estimated Operating Time: less than 1 year**

**Major Remedy Components**

- Soil in the Pits Area containing over 200 µg/kg of BAP would be excavated and disposed of offsite in a licensed facility. Fill soil would be added to replace the excavated material. Top soil would be added to those areas and seeded to promote the growth of a grass cover.
- LUCs would be used to maintain future industrial land use for all of the subunits at the ABRP OU (Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A)).

**Key ARARs Associated with this Remedy**

- 40 CFR 268 RCRA Land Disposal Restrictions
- 40 CFR 50.6 Air Particulate Limits



- 49 CFR 107, 171-179 - United States Department of Transportation (DOT)

The soil in the Pits Area containing levels of BAP in excess of 200 µg/kg would be excavated and shipped to a licensed waste facility. Soil samples would be taken to confirm that all of the contaminated soil was removed. Clean soil will be placed into the pits and revegetated. IROD reviews would be required because some residual waste would be left in place.

**Alternative 4S, Soil Cover over Pit 731-2A with Institutional Controls**

**Estimated Present Value Cost: \$213,208**

**Estimated Operating Time: less than 1 year**

**Major Remedy Components**

- A one-foot thick soil cover would be placed over Pit 731-2A. Three inches of top soil would be added and seeded to promote vegetation growth. Signs would be placed to state that hazardous waste was disposed of in place. Maintenance of the soil cover (mowing, repairing cracks, etc.) would be provided while USDOE maintains control of the land.
- LUCs would be used to maintain future industrial land use for all of the subunits at the ABRP OU (Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A)).

**Key ARARs Associated with this Remedy**

- 40 CFR 50.6 Air Particulate Limits

In this alternative, clean fill material from an on-site borrow pit would be placed over Pit 731-2A (the Pit containing surface soils with BAP contamination exceeding 200 µg/kg) at a minimum thickness of one foot, compacted, and



reseeded. Three inches of topsoil would be added to promote growth of a grass cover that will prevent erosion. IROD reviews would be required every five years because waste is left in place.

## **X. COMPARATIVE ANALYSIS OF ALTERNATIVES**

### **Evaluation Criteria**

Nine CERCLA remedy selection criteria, derived from the statutory requirements of CERCLA Section 121, have been established by the NCP. In selecting the preferred alternative, the CERCLA criteria were used to evaluate the alternatives developed in the CMS/FFS (WSRC 1997b). Seven of the criteria were used to evaluate all the alternatives, based on human health and environmental protection, cost, feasibility, and implementability issues. The preferred alternative was further evaluated based on the final two criteria: state acceptance and community acceptance.

The evaluation criteria are as follows:

- **Overall Protection of Human Health and the Environment** determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
- **Compliance with ARARs** evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.
- **Long-term Effectiveness and Permanence** considers the ability of an alternative to maintain protection of human health and the environment over time.

- **Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment** evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
- **Short-Term Effectiveness** considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
- **Implementability** considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
- **Cost** includes estimated capital and annual operations and maintenance costs as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
- **State/Support Agency Acceptance** considers whether the state agrees with the analyses and recommendations, as described in the Remedial Investigation/Feasibility Study and Proposed Plan.
- **Community Acceptance** considers whether the local community agrees with the analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

### **Comparative Analyses for Groundwater Alternatives**

In this section, each of the groundwater alternatives is compared to the others against each of the nine Superfund evaluation criteria. Alternative 4/5GW was not

included in the original CMS/FFS; however, it is included in the following analysis. The alternatives are discussed in the order in which they meet the specific criteria.

### ***Overall Protection of Human Health and the Environment***

Alternatives 4/5GW, 4GW and 5GW would give the greatest overall protection of human health and the environment. In these alternatives, most of the VOCs contained in the groundwater would either be degraded or removed.

Alternative 2GW provides some protection by preventing use of the contaminated groundwater aquifer; however, migration may take the plume beyond the controlled area or may move it to a lower aquifer.

Alternative 1GW provides no protection of human health or the environment.

### ***Compliance with ARARs***

#### **Chemical-Specific ARARs**

Alternatives 4/5GW, 4GW and 5GW would not fully meet the ARAR for MCL for groundwater for the interim action. Alternative 2GW could provide compliance if natural attenuation is demonstrated to degrade the VOCs in a reasonably short period. Alternative 1GW would not provide any compliance with MCLs.

#### **Location-Specific ARARs**

No location-specific ARARs are associated with any of these alternatives.

#### **Action-Specific ARARs**

Alternatives 1GW and 2GW do not have action-specific ARARs. Alternatives 4/5GW, 4GW and 5GW must meet air quality ARARs for the Clean Air Act and

well installation ARARs for the South Carolina Well Standards and Regulations. Air permits and well installation permits must be obtained.

#### **Long-Term Effectiveness and Permanence**

Alternatives 4/5GW, 4GW, and 5GW may provide permanent remediation solutions that give complete long-term effectiveness. The VOCs that are treated are degraded or removed from the groundwater. There is, however, some uncertainty as to whether any of these alternatives will completely remediate the contaminated groundwater at ABRP. Currently there is uncertainty as to whether the VOC contamination extends into multiple aquifers. The final alternative selected for the groundwater remediation at ABRP will use additional data gathered during the interim action and will be designed to provide long-term effectiveness and permanence for this OU.

Alternative 2GW may provide long-term effectiveness or permanence if natural attenuation can be demonstrated to degrade the VOCs in a reasonably short period. Alternative 1GW does not provide any long-term effectiveness or permanence.

#### **Reduction of Toxicity, Mobility, or Volume**

Alternative 5GW provides reduction in the toxicity and volume of the VOC contamination. Alternative 4GW provides equal reduction in toxicity when the spent carbon is incinerated. If the VOCs are reclaimed, then mobility is reduced instead of toxicity. Alternative 4/5GW would provide reduction in toxicity identical to 4GW when the BaroBall<sup>TM</sup> wells are used. If active extraction wells are used, it would provide reduction in toxicity and volume identical to 5GW. If bioremediation is found to be useful, then reduction in toxicity for 4/5GW could exceed either 4GW or 5GW because it combines the best features of both of these alternatives.

Alternative 2GW may provide some reduction in toxicity however; it is unlikely that natural attenuation is rapid enough to prevent migration of the contaminant plume. Alternative 1GW does not reduce the toxicity, mobility, or volume of the VOCs.

### **Short-Term Effectiveness**

Alternatives 1GW and 2GW provide the greatest short-term effectiveness, as they involve no remediation activities on the site. There currently is no risk to onsite workers. Neither of these two alternatives would ever reach the remedial response objectives.

Alternatives 4/5GW, 4GW, and 5GW all involve slight risks to remediation workers from the operating of heavy equipment during installation. Strict adherence to Occupational Safety and Health Administration (OSHA) regulations should greatly reduce these risks. Slight risks are also presented to the workers during remediation; however, following proper procedures should again greatly reduce these potential risks from inhalation or skin contact. All of these three alternatives are expected to reach interim remedial response objectives within two to five years.

### **Implementability**

Alternative 1GW would be the easiest to implement, as it involves No Action. Alternative 2GW would be relatively easy to implement as deed restrictions can be placed on the land through simple legal actions.

Alternatives 2GW, 4/5GW, 4GW, and 5GW all require obtaining permits for well installation. Alternatives 4/5GW, 4GW and 5GW also require permits for air emissions and permits will have to be obtained from the underground injection control program within the South Carolina Bureau of Water prior to using the

wells for the purpose of injection. All required equipment is readily available. Remediation using 4/5GW or 4GW is expected to take about two years while 5GW would require about five years.

### **Cost**

Alternative 1GW is the lowest cost alternative with a present value of \$8,346 for six 5-year IROD reviews. Alternative 2GW is estimated to have a present value of \$167,916. Alternative 5GW has an estimated present value of \$3,164,231. Alternative 4GW has a present value of \$3,323,638. The cost of Alternative 4/5GW will vary depending on whether passive extraction wells are sufficient, active extraction wells are required, or bioremediation is used. The exact cost is difficult to estimate. The range is expected to be from \$3,010,638 to \$4,221,228. The cost difference between Alternatives 4/5GW, 4GW, and 5GW should be considered insignificant with this level of estimating. Alternative 4/5GW has built-in contingencies that were lacking in Alternatives 4GW and 5GW if they did not operate as expected.

### **State Acceptance**

Alternatives 4/5GW, 4GW, and 5GW would likely meet with the state's acceptance since these remediation methods would permanently degrade or remove the VOCs from the groundwater. Alternatives 1GW and 2GW would not be acceptable because they will not reduce the level of VOCs to below the MCLs.

State of South Carolina and USEPA concurrence with the proposed interim action detailed in Section XI has been received. The preferred alternatives are protective of human health and the environment, are readily implementable, and are reasonably priced for the benefit received. For these reasons and those presented below under Community Acceptance, the State of South Carolina has accepted the proposed interim action.

### **Community Acceptance**

Alternatives 4/5GW, 4GW, and 5GW would likely meet with the community's acceptance since these remediation methods would permanently degrade or remove the VOCs from the groundwater. Alternatives 1GW and 2GW would not be acceptable because they will not reduce the level of VOCs to below the MCLs.

Community acceptance of the preferred alternatives is assessed by giving the public an opportunity to comment on the IAPP. The public was notified of a public comment period through mailings of the SRS *Environmental Bulletin*, and advertisements in the *Aiken Standard*, the *Allendale Citizen Leader*, the *Augusta Chronicle*, the *Barnwell People-Sentinel*, and *The State* newspapers and through announcements on local radio stations. In addition, the IAPP was presented to the SRS CAB Environmental Restoration and Waste Management Subcommittee in an open public meeting on January 11, 2000, during the public comment period. Public comments concerning the proposed remedy are addressed in the Responsiveness Summary of this IROD.

### **Comparative Analyses for Soil Alternatives**

In this section, each of the soil alternatives is compared to the other alternatives against the nine Superfund evaluation criteria. The alternatives are discussed in the order in which they meet the specific criteria. The original analysis from the CMS/FFS has been modified to include a soil cover (Alternative 4S) and takes into consideration the additional volume of soil estimated to be excavated and disposed if Alternative 3S is selected.

### ***Overall Protection of Human Health and the Environment***

All four alternatives protect the environment because the maximum detected value for mercury, the only ecological COC, is well below the remedial goal

option (RGO). Alternative 3S would provide the greatest overall protection of human health. Alternative 3S would remove the BAP from hot spots in Pit 731-2A and place deed restrictions on the land. Alternative 4S would provide adequate protection of human health by placing a soil cover over the contaminated soil which would act as a barrier to prevent contact. The contaminated soil would be left in place and could still pose future risk if the soil cover is breached or excavation is allowed in the area. Deed restrictions are included to help prevent this future exposure. Alternative 2S would reduce the level of potential risk to human health by limiting the future land use to industrial use only. Alternative 1S provides no protection of human health.

#### ***Compliance with ARARs***

##### **Chemical-Specific ARARs**

There are no applicable chemical-specific ARARs for the ABRP.

##### **Location-Specific ARARs**

No location-specific ARARs are associated with any of these alternatives.

##### **Action-Specific ARARs**

Construction activities (3S and 4S) must meet OSHA and air particulate (40 CFR 50.6) ARARs. Any contaminated soil shipped off-site (Alternative 3S) must meet 49 CFR DOT transportation requirements. Final waste disposal must meet 40 CFR Part 268 Land Disposal Requirements.

##### **Long-Term Effectiveness and Permanence**

Alternative 3S provides long-term effectiveness and permanence for the degradation or removal of BAP to reduce human health risk. Alternative 4S



provides some degree of long-term effectiveness and protection provided excavation at the site is prevented through the use of deed restrictions. Alternative 2S provides some long-term effectiveness for human health provided the deed restrictions are enforced to prevent future residential land use; however, a level of  $1 \times 10^{-6}$  risk is not attained. Alternative 1S does not provide for either long-term effectiveness or permanence.

### **Reduction of Toxicity, Mobility, or Volume**

Alternative 3S removes BAP-contaminated soil and places it in an approved facility where its mobility is greatly reduced. Alternative 4S does not reduce the toxicity or volume of the waste. This alternative does limit the mobility by preventing the wind or rain from transporting contaminated soil. It also prevents easy contact with human receptors. Alternatives 1S and 2S do not reduce the toxicity, mobility, or volume of any contaminants.

### **Short-Term Effectiveness**

Alternatives 1S and 2S provide the greatest short-term effectiveness, as they involve no remediation activities on the site. There currently is no risk to onsite workers. These two alternatives would never achieve remedial response objectives.

Both Alternative 4S and 3S involve a slight risk to remediation workers from the operating of heavy equipment during removal. There is more of a chance for worker contamination during excavation of the contaminated soil (4S) than with just placing a soil cover over it (3S). Strict adherence to OSHA regulations should greatly reduce these risks. Slight risks are also presented to the workers during remediation; however, following proper procedures should again greatly reduce these potential risks from dust inhalation or skin contact. Both of these alternatives would attain remedial response objectives for future industrial land use within one year.

### **Implementability**

Alternative 1S would be the easiest to implement, as it involves No Action. Alternative 2S would be relatively easy to implement as deed restrictions can be placed on the land through simple legal actions and SRS access controls are already in place. Contractors are readily available for implementation of either Alternative 4S or 3S. Facilities for disposal of contaminated soil are readily available.

### **Cost**

Alternative 1S is the lowest cost alternative with a present value of \$8,346 for six 5-year ROD reviews. Alternative 2S is estimated to have a present value of \$10,346. Alternative 4S has an estimated present value cost of \$213,208. Alternative 3S has a revised estimated present value of \$630,346.

### **State Acceptance**

Alternative 3S would likely meet with the state's acceptance since this remediation method would permanently remove the BAP from the soil containing levels in excess of the human health RGO for a hypothetical future industrial worker. Alternative 4S would also likely meet with the state's acceptance because the soil cover with deed restrictions provides a lower cost, effective alternative for this level of soil contamination. Alternative 2S would also likely meet with the state's acceptance as part of the final remedy; however, it is not sufficient to meet a  $1 \times 10^{-6}$  industrial risk level on its own. Alternatives 3S and 2S both restrict future land use to industrial to protect human health and thus they would both likely be acceptable to the state. Alternative 1S would not be acceptable because it does not protect human health.

State of South Carolina and USEPA concurrence with the proposed interim action detailed in Section XI has been received. The preferred alternatives are protective

of human health and the environment, are readily implementable, and are reasonably priced for the benefit received. For these reasons and those presented below under Community Acceptance, the State of South Carolina has accepted the proposed interim action.

### **Community Acceptance**

The community would likely accept Alternatives 4S, 3S and 2S for the same reasons that the state would accept them. The community would also likely reject Alternative 1S.

Community acceptance of the preferred alternatives is assessed by giving the public an opportunity to comment on the IAPP. The SRS CAB provided Recommendation Number 114 supporting the proposed remedial action at the ABRP. No other public comments were received of the IAPP. Additional CAB comments concerning the proposed remedy are addressed in the Responsiveness Summary of this IROD.

### **Summary of the Comparative Costs of the Alternatives**

Table 2 is a summary of the costs of the four groundwater alternatives. Table 3 is a summary of the costs of the three soil alternatives as provided in the CMS/FFS. Table 4 provides revised estimated soil alternative costs based on data obtained in the 1998 sampling event. A 5% discount rate was used for all present worth calculations.

## **XI. THE SELECTED REMEDY**

The remedy described in the following sections may change during remedial design to reflect construction processes. Changes to the remedy described in this IROD will be documented in the Administrative Record File utilizing a memo, an Explanation of Significant Difference (ESD), or an IROD amendment.

**TABLE 2. SUMMARY OF THE COSTS OF THE GROUNDWATER REMEDIATION  
ALTERNATIVES**

<b>Alternative</b>	<b>Present Value</b>
1GW - No Action	<b>\$8,346</b>
2GW - Institutional Controls, Monitoring	<b>\$167,916</b>
4GW - Active Air Sparging with Active Soil Vapor Extraction, Carbon Adsorption for Offgas Treatment, Monitoring	<b>\$3,323,638</b>
5GW - Active Air Sparging with Passive Soil Vapor Extraction (BaroBall™ Wells) and Enhanced Biodegradation, Carbon Adsorption for Offgas Treatment, Monitoring	<b>\$3,164,231</b>
4/5GW - Active Air Sparging with Passive Soil Vapor Extraction (BaroBall™ Wells) and Enhanced Biodegradation, Carbon Adsorption for Offgas Treatment, GW Monitoring (this Alternative is a hybrid of Alternatives 4GW and 5GW)	<b>\$3,010,638 to \$4,221,228</b>

Note: Alternative 3GW (Recirculation wells) was deleted during screening due to implementability problems. Soil conditions at ABRP are not conducive to forming a recirculation cell.

**TABLE 3. SUMMARY OF THE ORIGINAL CMS/FFS COSTS OF THE SOIL  
REMEDIALATION ALTERNATIVES**

<b>Alternative</b>	<b>Present Value</b>
1S - No Action	<b>\$8,346</b>
2S - Institutional Controls	<b>\$10,346</b>
3S - Soil Extraction and Off-Site Disposal with Institutional Controls	<b>\$76,446</b>

**TABLE 4. SUMMARY OF THE REVISED COSTS OF THE SOIL REMEDIATION  
ALTERNATIVES**

<b>Alternative</b>	<b>Present Value</b>
1S - No Action	<b>\$8,346</b>
2S - Institutional Controls	<b>\$10,346</b>
3S (revised) - Soil Extraction and Off-Site Disposal with Institutional Controls	<b>\$630,346</b>
4S (new) - Soil Cover over Pit 731-2A with Institutional Controls	<b>\$213,208</b>

Note: Costs revised from those prepared in the CMS/FFS using data obtained in the 1998 sampling event. Results indicated a significantly larger volume of soil to be excavated for Alternative 3S.

### **Detailed Description of the Selected Groundwater Alternative**

The selected interim alternative for groundwater remediation is Alternative 4/5GW. This alternative uses active air sparging with either active or passive SVE, which allows flexibility in the selection of the appropriate type of extraction well. Lower-cost passive BaroBall™ wells will be used whenever possible. When higher concentrations of VOCs are encountered, the use of active SVE wells may be used to reduce the overall remediation time. Enhanced bioremediation will be evaluated during Stage 1, based on the performance of the air sparging/PSVE system. Should the air sparging/PSVE system prove to have a significantly smaller zone of influence than anticipated (i.e., < 50% of a projected 15 foot radius of influence), enhanced bioremediation would be evaluated as an added remedial measure to compensate in part for the reduced effects of the engineered system. Enhanced bioremediation would involve injecting methane, air, and nutrients into the groundwater to help establish bioremediation of the VOCs in situ. The injection system would be trailer-mounted so that it can be moved from well to well as needed.

The optimum air sparging configuration for a specific site cannot be determined without actually operating a small system first to gather information concerning the radius of influence of the wells, the efficiency of the system, optimum air sparging levels, etc. Therefore, a staged approach will be used in remediating the ABRP VOC plume. Figure 19 shows an overview of the ABRP preferred alternatives. Figure 20 shows a schematic design of the air sparging and PSVE well system to be used for the ABRP.

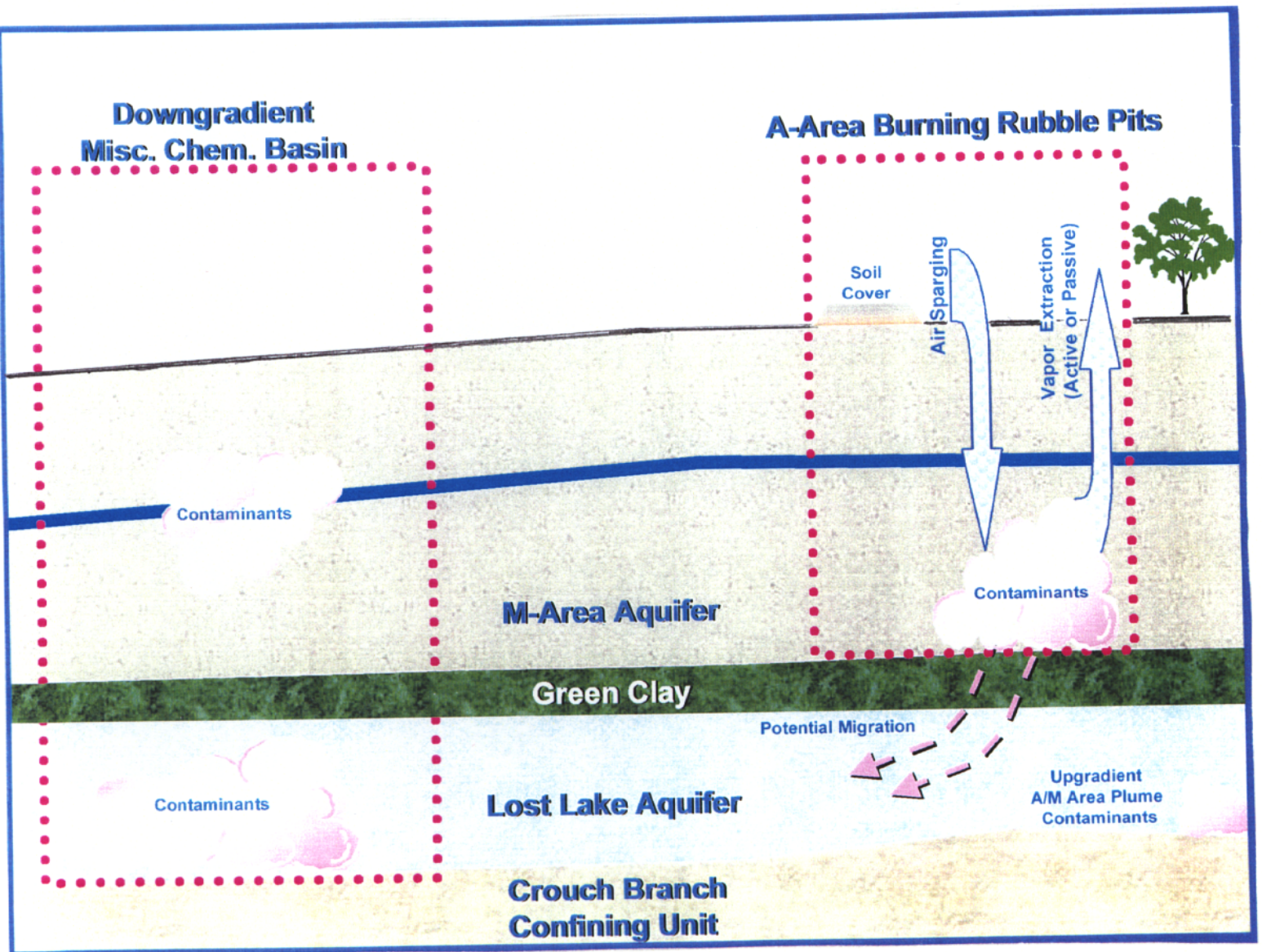
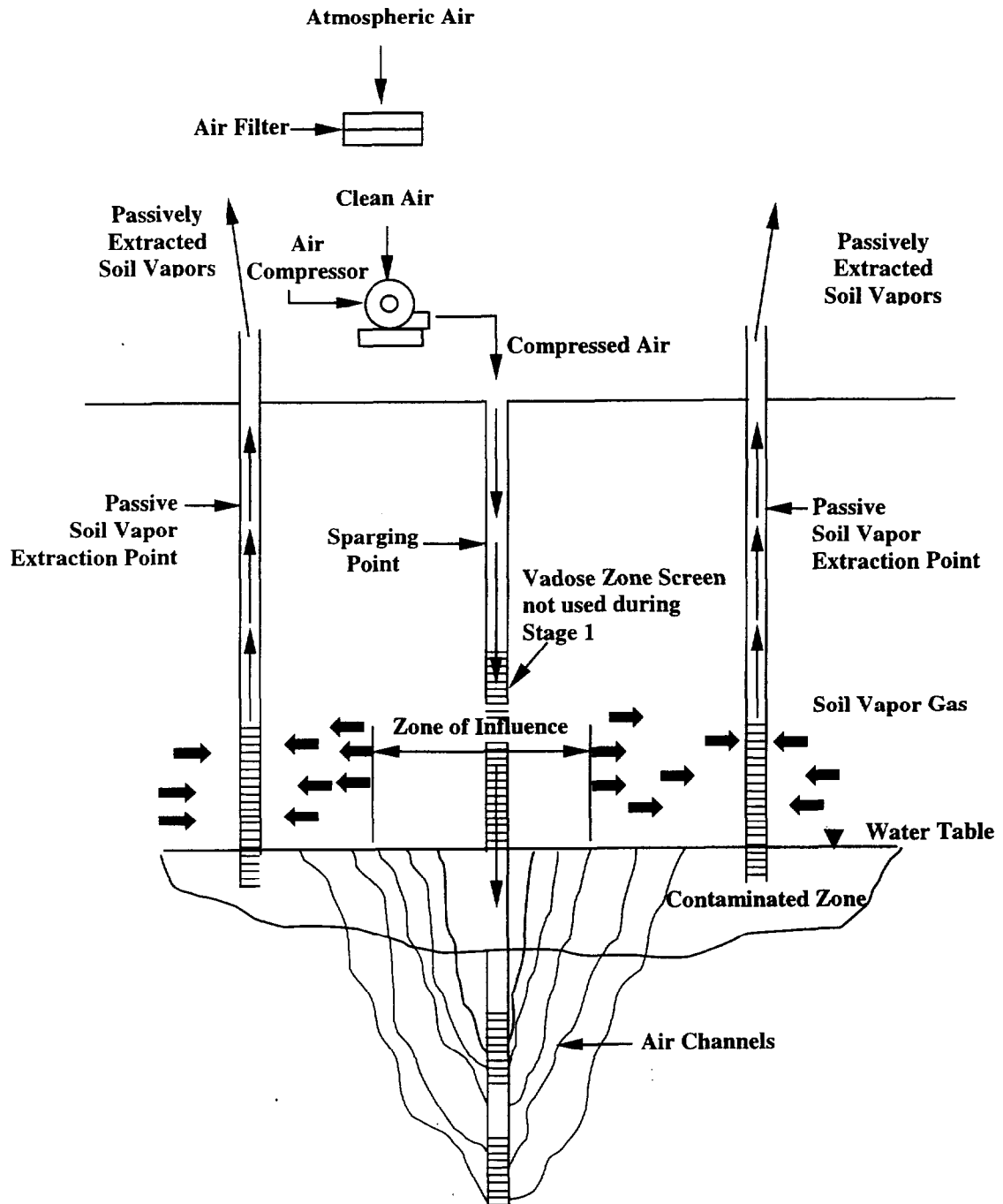


Figure 19. Overview of the ABRP Preferred Alternatives



**Figure 20. Schematic Design of the Air Sparging and Passive Soil Vapor Extraction Well System**

In the first stage, 10 active air sparging wells, each with 3 BaroBall™ passive extraction wells (as presented in Alternative 5GW), will be installed and operated for approximately 12 months. During this time, operating data and effectiveness monitoring data will be gathered to determine the suitability of this system for remediating the plume. Nutrient injection to stimulate bioremediation may also be evaluated to determine its effectiveness. The second stage will provide additional active air sparging wells with either passive or active (as presented in Alternative 4GW) extraction wells. The number and type of wells will be determined using data from Stage 1.

The PSVE system was selected for Stage 1 because of the relatively low levels of VOC contamination ( $<1000 \mu\text{g/L}$ ) found in the groundwater. SRS will evaluate the effectiveness of the PSVE system during the initial stage. Methods for assessing effectiveness may include, but are not limited to, the following:

- 1) Measuring extraction flow rates against calculated VOC stripping rates from groundwater toward calculating the quantity of VOCs removed;
- 2) Monitoring to determine if VOC vapors are migrating outside the PSVE well zone of capture.

Should the PSVE system prove to be inadequate, the system could be modified to become an active SVE system (as described in Alternative 4GW), as necessary. This option would include the use of a vacuum pump with associated piping and hookups to the PSVE wells (essentially, the BaroBall™ check valve would be removed and replaced with piping and hookups to the vacuum pump). Carbon adsorption units would be added should VOC-emission concentrations exceed air permit levels.



Stage 2 of the remediation would incorporate the operating and effectiveness data obtained from Stage 1 to design a more extensive system to address the  $>100 \mu\text{g/L}$  VOC plume. Stage 2 will also operate for approximately 12 months. The extraction method (PSVE and/or SVE) will be selected based on performance results of Stage 1. Performance evaluation reports will be submitted to SCDHEC and USEPA at the conclusion of each stage of the groundwater interim action.

An interim action, rather than a final action, is proposed to advance groundwater remediation for contaminants in the M-Area Aquifer while allowing time to assess uncertainties in the deeper Lost Lake Aquifer. During the interim period these uncertainties will be evaluated with the objective to define a remedy that, with high confidence, will achieve final remedial goals while being cost effective.

The interim groundwater remediation system will be designed and operated to achieve contaminant mass removal and to control further contaminant plume migration within the M-Area Aquifer and to the underlying Lost Lake Aquifer. The interim action for groundwater specifies the deployment of air sparging wells with attendant SVE to move contaminants from the saturated to the unsaturated zone and finally to the surface for treatment or release to the atmosphere as required by Air Quality Control Requirements.

The sparging wells would be installed under the interim action in two stages with the objective of confirming their optimal number, locations, and maximum efficiency. The first stage (estimated duration is 12 months) will be used to demonstrate air sparging effectiveness and gain operational data under specific media and mechanical parameters. This first stage deployment will commit adequate resources to effect mass removal by having its primary focus within the areas of higher plume concentrations.

The data gained from the first stage will be used in the design of the second stage (estimated duration is 12 months) to assure additional wells will result in a system

that will meet remedial goals (removing VOC concentrations greater than 100 µg/L) within an appropriate cost and schedule. Quantitative design criteria would be established for the second stage based on data collected during the first stage to include measurements on potentiometric level, groundwater quality, and offgas concentrations. This data will facilitate quantification of flow rates, zones of influence, and removal efficiency rates. Utilizing the interim approach, SRS can effectively evaluate system performance and incorporate modifications as necessary to achieve final RAOs.

This interim action approach will significantly reduce the uncertainties associated with groundwater components of the unit and help to arrive at a final remedy that can be confidently approved. Benefits from this approach include the following:

- initiation of an early interim groundwater action while achieving a remedy that addresses the plume conditions for the area;
- collection of data to assess the impacts of the OU on the Lost Lake Aquifer; and
- addressing uncertainties concerning the potential for the ABRP VOC-contaminated plume to commingle with the A/M Area or MCB VOC-contaminated plumes.

Based on information currently available, the lead agency believes the Preferred Alternative (final action for soil, interim action for groundwater) provides the best balance of tradeoffs among the other alternatives with respect to the evaluation criteria. The USDOE expects the Preferred Alternative to satisfy the statutory requirement in CERCLA Section 121 (b) to 1) be protective of human health and the environment; 2) be cost-effective; 3) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and 4) satisfy the preference for treatment as a principal element (or justify not meeting the preference).

This interim action will not meet the groundwater MCL ARAR; however, the MCLs are ARARs for the final remedial action. This is consistent with the waiver provisions of 40 CFR §300.430(f)(1)(ii)(C)(1) which do not require an interim action alternative to meet an ARAR, provided the alternative is an interim measure and will become part of a total remedial action that will attain the ARARs.

The groundwater interim action is compatible with any anticipated final groundwater remedial actions at ABRP. The final groundwater remedy will be selected through development of a final CMS/FFS, a final SB/PP, and a final ROD based on the information and data collected during the interim action.

During this interim action, additional groundwater characterization will be performed to address the uncertainty with respect to possible VOC contamination in the underlying Lost Lake Aquifer Zone. This additional characterization will include the installation of four monitoring wells in the Lost Lake Aquifer Zone positioned to monitor the aquifer zone both upgradient and downgradient of the ABRP. The results and costs of this additional characterization will be submitted as an attachment to the Post IROD Stage 1 performance results.

### **Detailed Description of the Selected Soil Alternative**

The selected final alternative for soil remediation is Alternative 4S, Soil Cover over Pit 731-2A, with Institutional Controls. This alternative requires the installation of a minimum one-foot thick soil cover over Pit 731-2A. This soil cover was not evaluated in the CMS/FFS; however, additional sampling at the OU indicated that the potential isolated locations ("hot spots") of BAP contamination in the surface soil were more prevalent than previous data indicated during the RI. The additional 1998 sampling event indicated that the BAP contamination has spread sporadically throughout areas of the surface soil in Pit 731-2A to a depth of 2 feet. The highest concentration sampled (10,260 µg/kg) poses a risk to current and future workers of  $6 \times 10^{-5}$ . Most of the surface soil samples showed BAP concentrations at

significantly lower levels. It would be very expensive to thoroughly sample all of the surface soil in Pit 731-2A to determine every hot spot. Excavation of all of the surface soil would require removal of substantially larger volumes of contaminated soil than were originally evaluated in the CMS/FFS, altering the economics of this alternative. For these reasons, a soil cover is an appropriate additional remedial alternative to consider for BAP in ABRP soils.

A one-foot thick soil cover over Pit 731-2A, along with LUCs to maintain future industrial land use, is a cost-effective alternative that will eliminate risk to the current workers during groundwater remediation and is sufficient for use as the final remedy for the source term. It fully reduces risk to current and future workers under an industrial land use scenario to less than  $1 \times 10^{-6}$  and is consistent with the final remedy for the OU. This alternative is consistent with USEPA guidance and the NCP for sites that have relatively large volumes of waste with low levels of contamination and is an effective use of risk management principles. It is therefore proposed that a one-foot thick soil cover be placed over Pit 731-2A as a final action for BAP contamination in the soil. Figure 21 shows the location of the proposed soil cover.

Per the USEPA-Region IV LUC Policy, a LUCAP for SRS has been approved by the regulators. In addition, a LUCIP for the ABRP will be developed and submitted to the regulators for their approval with the post-IROD documentation. The LUCIP will detail how SRS will implement, maintain, and monitor the LUC elements of the ABRP preferred alternative to ensure that the remedy remains protective of human health and the environment. The LUCIP will address the final soil portion of the remedy, including cover maintenance.

In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste

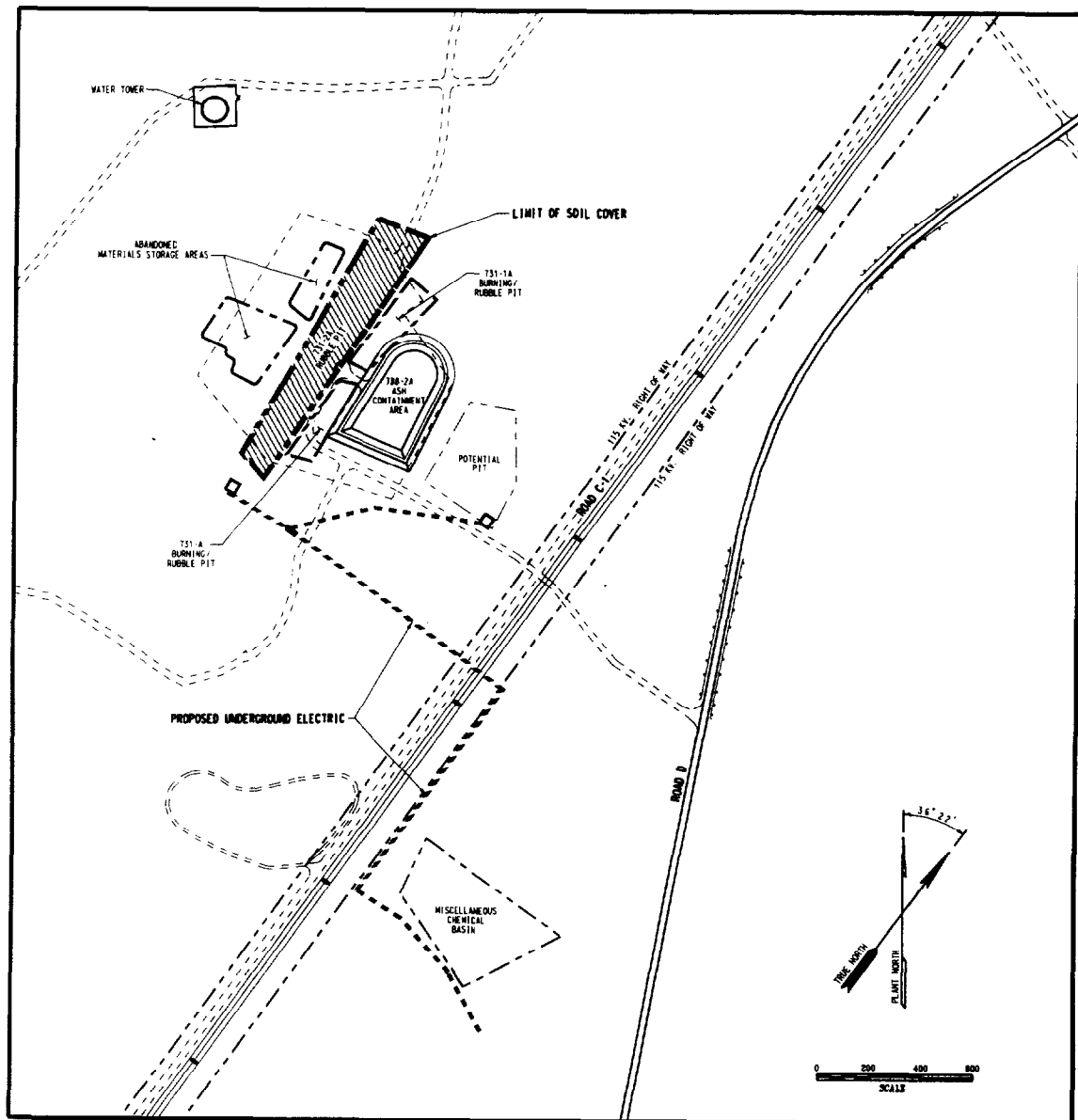


Figure 21. Proposed Soil Cover (Alternative 4S) Over Pit 731-2A

management and disposal activities as well as remedial actions taken on the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of waste. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility if contamination will remain at the unit.

The deed shall also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or the residual contamination no longer poses an unacceptable risk under residential use. Any reevaluation of the need for deed restrictions will be done through an amended ROD with USEPA and SCDHEC approval. In addition, if the site is ever transferred to nonfederal ownership, a survey plat of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

### **Cost Estimate for the Selected Remedy**

#### ***Soil Remediation Costs***

The costs for the soil cover over Pit 731-2A are shown in Table 5.

#### ***Groundwater Remediation Costs***

The costs for the selected groundwater remedy were developed using “best case” (Table 6) and “worst case” (Table 7) scenarios for Stage 2. In the best case scenario, it was assumed that 30 additional air sparge wells, each with 3 BaroBall™ extraction wells would be required. All of these wells were assumed to be installed using the CPT. In the worst case scenario, it was assumed that in addition to the 30 well systems mentioned above, an additional 20 drilled active

**TABLE 5. COST SUMMARY FOR THE SOIL COVER FOR ABRP**

Item	Qty	Cost	Present Value Factor	Present Value	Total Present Value
<b>Capital Costs</b>					
<b>Soil cover @\$78,548/acre</b>	2.58	\$78,548	1	\$202,862	
- 900' x 125' = 112,500 ft <sup>2</sup>					
- 112,500 ft <sup>2</sup> / 43,560 ft <sup>2</sup> /acre = 2.58 acre					
<b>Total Capital Costs</b>					<b>\$202,862</b>
<b>Operating &amp; Maintenance</b>					
Institutional Controls	1	\$10,346	1	\$10,346	
<b>Total Operating &amp; Maintenance Costs</b>					<b>\$10,346</b>
<b>Total</b>					<b>\$213,208</b>

Note: Soil cover cost includes 1 foot thick native soil with a high clay content, 3" of top soil, 10 mile roundtrip hauling, compacting, backfilling, hydroseeding, and mulch.

Institutional controls assumes a \$2,000 fee for deed filing and 5-year ROD reviews for 30 years. The ROD reviews are assumed to cost \$3,000 each. The present value of the 6 ROD reviews is \$8,346 using a 5% discount factor.

**TABLE 6. GROUNDWATER SELECTED REMEDY COSTS (BEST CASE SCENARIO)**

Item	Qty	Cost	Present Value Factor	Present Value	Total Present Value
<b>Capital Costs for Stage 1</b>					
Air Sparge Well w/3 BaroBall™ extraction wells (assumes CPT)	10	\$8,000	1	\$80,000	
Prepare area, temp roads, electrical supply, etc.	1	\$500,000	1	\$500,000	
Piping, installation, mobile trailer, vehicle, etc.	1	\$105,000	1	\$105,000	
Blowers	2	\$9,000	1	\$18,000	
Subtotal of Capital Costs				\$703,000	
Engineering, overhead, etc. (50% of subtotal of capital costs)				\$351,500	
<b>Total Capital Costs for Stage 1</b>				<b>\$1,054,500</b>	
<b>Capital Costs for Stage 2 (Best Case)</b>					
Air Sparge Well w/3 BaroBall™ extraction wells (assumes CPT)	30	\$8,000	1	\$240,000	
Additional piping, installation, etc.	1	\$315,000	1	\$315,000	
Subtotal of Capital Costs				\$555,000	
Engineering, overhead, etc. (50% of subtotal of capital costs)				\$277,500	
<b>Total Capital Costs for Stage 2 Best Case</b>				<b>\$832,500</b>	
<b>Total Capital Costs</b>					<b>\$1,887,000</b>
<b>Operating and Maintenance Costs</b>					
Start-Up	1	\$153,600	1	\$153,600	
Annual Operating Cost	2	\$300,000	1.9059	\$571,770	
Prepare RD/RA report	1	\$150,000	1	\$150,000	
Shutdown (after 2 years)	1	\$100,000	0.907	\$90,700	
Monitoring (assumed for 30 years)	30	\$10,000	15.7568	\$157,568	
<b>Total Operating and Maintenance Costs</b>					<b>\$1,123,638</b>
<b>Total Present Value (Best Case)</b>					<b>\$3,010,638</b>

Note: A discount factor of 5% was used for all Present Value calculations. CPT is cone penetrometer technology. Site conditions may require the use of drilled wells resulting in a higher installation cost.



**TABLE 7. GROUNDWATER SELECTED REMEDY COSTS (WORST CASE SCENARIO)**

Item	Qty	Cost	Present Value Factor	Present Value	Total Present Value
<b>Capital Costs for Stage 1</b>					
Air Sparge Well w/3 BaroBall™ extraction wells (assumes CPT)	10	\$8,000	1	\$80,000	
Prepare area, temp roads, electrical supply, etc.	1	\$500,000	1	\$500,000	
Piping, installation, mobile trailer, vehicle, etc.	1	\$105,000	1	\$105,000	
Blowers	2	\$9,000	1	\$18,000	
Subtotal of Capital Costs				\$703,000	
Engineering, overhead, etc. (50% of subtotal of capital costs)				\$351,500	
<b>Total Capital Costs for Stage 1</b>				<b>\$1,054,500</b>	
<b>Capital Costs for Stage 2 (Worst Case)</b>					
Air Sparge Well w/3 BaroBall™ extraction wells (assumes CPT)	10	\$8,000	1	\$80,000	
Additional piping, installation, etc.	1	\$315,000	1	\$315,000	
Drilled sparge wells	20	\$10,000	1	\$200,000	
Drilled extraction wells	60	\$10,000	1	\$600,000	
Carbon Adsorption System	1	\$10,000	1	\$10,000	
Methane System	1	\$10,000	1	\$10,000	
Injection System	1	\$20,000	1	\$20,000	
Subtotal of Capital Costs				\$1,235,000	
Engineering, overhead, etc. (50% of subtotal of capital costs)				\$617,500	
<b>Total Capital Costs for Stage 2 Worst Case</b>				<b>\$1,852,500</b>	
<b>Total Capital Costs</b>					<b>\$2,907,000</b>
<b>Operating and Maintenance Costs</b>					
Start-Up	1	\$153,600	1	\$153,600	
Annual Operating Cost	2	\$400,000	1.9059	\$762,360	
Prepare RD/RA report	1	\$150,000	1	\$150,000	
Shutdown (after 2 years)	1	\$100,000	0.907	\$90,700	
Monitoring (assumed for 30 years)	30	\$10,000	15.7568	\$157,568	
<b>Total Operating and Maintenance Costs</b>					<b>\$1,123,638</b>
<b>Total Present Value (Worst Case)</b>					<b>\$4,221,228</b>

Note: A discount factor of 5% was used for all Present Value calculations. CPT is cone penetrometer technology. Site conditions may require the use of drilled wells resulting in a higher installation cost.

air sparging wells and 60 drilled active extraction wells would be needed, along with an interconnecting pipe network. Stage 2 would also require a carbon adsorption system and a methane injection system (to stimulate bioremediation). The costs for institutional controls were not added to any of the groundwater alternative costs because these costs were already added to the soil remediation costs. Institutional control actions would cover both the soil and groundwater media.

### **Estimated Outcomes of Selected Remedy**

After the remedy is completed, the OU is expected to maintain an industrial land use. The soil cover will prevent exposure and uptake of BAP to current and future workers. The BAP left in place beneath the soil cover would not render this site suitable for residential or unlimited land use. Therefore, LUCs will be maintained to restrict future land use. The soil cover reduces the risk to current and future workers to  $1 \times 10^{-6}$ .

The groundwater associated with ABRP is not expected to meet the MCLs after completion of the two-year interim action. This action will greatly reduce the level of VOC concentration in the groundwater; however, additional remedial action will be necessary to achieve reduction to the MCLs. Data obtained from the operation of the remedy during the interim action will be very useful in determining further action.

There were no ecological risks posed by the ABRP.

## **XII. STATUTORY DETERMINATIONS**

This IROD identifies final remedial goals for surface soils. However, due to uncertainties associated with determining the impact to the deeper Lost Lake Aquifer, determining the potential for commingling with the downgradient MCB

plume and the upgradient A/M Area plume, and site-specific remedial technology efficiencies, the ability and practicality of achieving ARARs-based final remedial goals for ABRP groundwater cannot be determined. Interim action to begin groundwater remediation while continuing to clarify regional groundwater contamination issues is protective of human health and the environment.

The selected interim groundwater alternative is consistent with the interim RAOs and any final action. The alternative selection focused upon the key ARARs that apply to the limited scope of the interim action. The alternative selection also considered the final action ARARs to ensure that the interim action and any final action are compatible. Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this action does utilize treatment and thus is a furtherance of that statutory mandate. The BAP contamination of the surface soil in Pit 731-2A is widespread at relatively low levels. The soil cover alternative combined with LUCs is consistent with USEPA guidance and the NCP for sites that have relatively large volumes of waste with low levels of contamination and is an effective use of risk management principles. The selected remedy will be protective of human health and ecological receptors by preventing exposure to and/or assimilation of the COCs. It also complies with federal and state ARARs and is cost-effective. The soil cover is the final action for surface soil contamination at the ABRP.

An SRS RCRA permit modification is not required at this time since this is an interim action. However, the final permit modification will (1) include the final selection of remedial alternatives under RCRA, (2) be sought for the entire ABRP with the final SB/PP, and (3) will include the necessary public involvement and regulatory approvals. This IROD also satisfies the RCRA requirements for an Interim Measures Work Plan.

Per the USEPA-Region IV LUC Policy, a LUCAP for SRS has been approved by the regulators. In addition, a LUCIP for ABRP will be developed and submitted to the regulators for their approval with the post-IROD documentation. The LUCIP will detail how SRS will implement, maintain, and monitor the LUC elements of the ABRP preferred alternative to ensure that the remedy remains protective of human health and the environment.

In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. Those actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of waste. These requirements are also consistent with the intent of the RCRA deed notification requirements at final closure of a RCRA facility if contamination will remain at the unit.

The deed shall also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or the residual contamination no longer poses an unacceptable risk under residential use. Any reevaluation of the need for deed restrictions will be done through an amended ROD with USEPA and SCDHEC approval.

In addition, if the site is ever transferred to nonfederal ownership, a survey plat of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

The level of VOCs in the groundwater warrants a remedy in which active air stripping with either active or passive SVE with monitoring is a practical alternative. This remedy utilizes permanent solutions and alternative treatment to

the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. This is not the final groundwater remedy for the ABRP. Groundwater at the site will continue to undergo study in support of the final remedy selection.

This interim action is protective of human health and the environment; complies with federal and state ARARs, except for meeting groundwater MCLs, which is justified by a waiver for this limited-scope action; and is cost-effective. Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action utilizes treatment and thus is in furtherance of that statutory mandate. Because this action does not constitute the final remedy for the ABRP, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action. Subsequent actions are planned to address fully the threats posed by the conditions at this OU. Because this remedy will result in hazardous substances remaining on site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within five years after commencement of the remedial action. Because this is an interim action ROD, review of this OU and of this remedy will be continuing as USDOE continues to develop remedial alternatives for the ABRP.

An ARARs waiver under §300.430(f)(1)(ii)(C) of the NCP for all groundwater COCs has been invoked because the selected remedy is an interim action measure that will become part of a total remedial action that will ultimately attain ARARs.

### **XIII. EXPLANATION OF SIGNIFICANT CHANGES**

The IAPP (WSRC 1999b) provided for involvement with the community through a document review process and a public comment period. Comments received during the 30-day public comment period (December 21, 1999, through January 19, 2000) are addressed in Appendix A of this IROD. There were no significant changes to the selected remedy as a result of public comments.

Recently available aerial photographs from the 1950's through the 1980's have revealed the potential presence of a "trench/pit" as depicted on Figure 2. The location of this "trench/pit" corresponds to the eastern end of and underneath the current A-Area Ash Pile (788-2A), an active facility. Also, a "ditch" appears to extend from the northern end of the "trench/pit" to the east toward the power line road. These photographs have been geo-referenced with the existing physical markers (i.e., roads etc.) in order to determine the location of the potential "trench/pit" as seen on the photographs with the current topography of the area.

- The presence of the recently discovered "trench/pit" and the "ditch" will be investigated by performing GPR in the suspect areas.
- If confirmed by GPR, trenching of the "trench/pit" and "ditch" will be attempted.
- Physical sampling of the contents and the area soils adjacent to the "trench/pit" and "ditch" will be performed.

Characterization of the suspect areas will be performed in order to ascertain whether a "trench/pit" and/or a "ditch" are present as depicted on the aerial photography. The characterization is to determine whether or not materials were disposed of at these areas; determine the lateral and vertical extent of any

contamination through the sampling methodology; and determine whether these materials pose an unacceptable risk to human health and/or the environment.

The proposed characterization of the potential “trench/pit” area and “ditch”, where necessary, will utilize Cone Penetrometer or Geoprobe Technology to push through the ash in order to obtain samples of the contents of the “trench/pit” where it underlies the Ash Pile. The proposed sampling locations for the “trench/pit” and the “ditch” will be to a depth sufficient to be beneath the base of the “trench/pit” and the “ditch”. The areas adjacent to the “trench/pit” and the “ditch” will also be sampled. All samples will be analyzed for those constituents on the target analyte/compound list with tentatively identified compounds and the radiological screens of gross alpha and nonvolatile beta.

As discussed on May 4, 2000 by the USEPA – Region IV, SCDHEC, and USDOE, the investigation of the potential contaminated areas will not impact the remedial action start date for the ABRP interim action, and therefore, should proceed as a separate activity concurrent with Stage 1 of the interim action. Based on a technically practicable and cost effective management approach, SRS proposes to include the additional investigation as part of the ABRP OU. A sampling program delineating the proposed additional investigation will be presented in a Work Plan addendum. A schedule including the proposed investigation along with the interim action is presented in Figure 22.

#### **XIV. RESPONSIVENESS SUMMARY**

The Responsiveness Summary is included as Appendix A of this document.

## **XV. POST-IROD DOCUMENT SCHEDULE AND DESCRIPTION**

The Post-IROD document, the Interim Corrective Measures Implementation/ Remedial Action Implementation Plan (ICMI/RAIP), will provide a description of the soil cover design and the design process for the air injection system and vapor extraction system to remediate the contaminated groundwater and the soil cover to remediate contaminated soil. The ICMI/RAIP will be revised following Stage 1, as necessary, to incorporate additional design criteria for Stage 2.

The ICMI/RAIP will include the following:

- General description of unit,
- Remedial action schedule,
- Discussion of design activities, design criteria, and permitting requirements,
- Design drawings and a discussion of the permit and construction specifications,
- Remedial design change control and USEPA/SCDHEC review of remedial design changes,
- Waste management,
- A discussion of Quality Assurance, Health and Safety Plan and Emergency Plan Implementation Strategy,
- Requirements for project closeout, and
- Land Use Controls Implementation Plan.

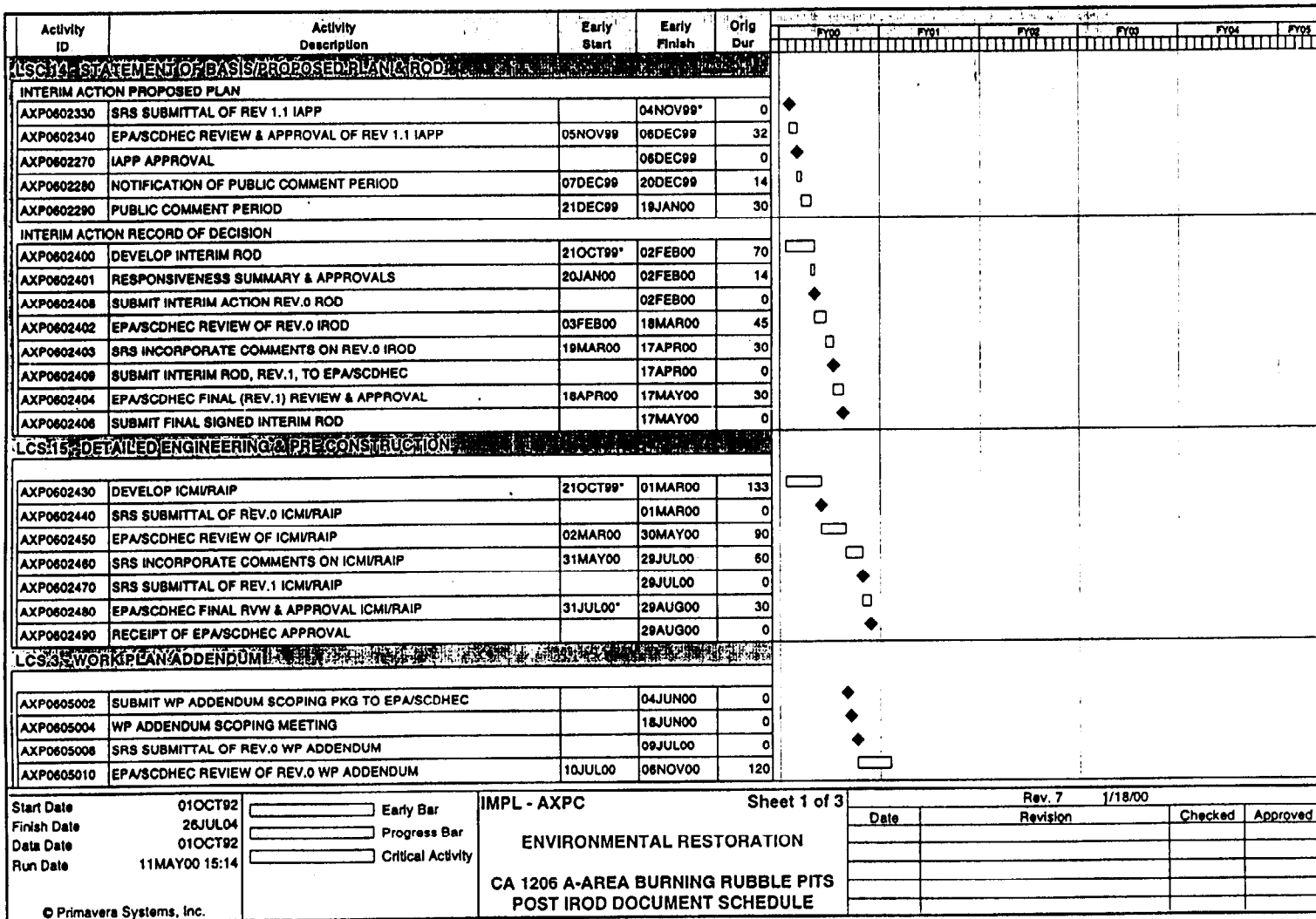


Figure 22 provides a schedule of interim action regulatory document submittals and construction activities. The ICMI/RAIP will be submitted for USEPA and SCDHEC review approximately six months prior to the interim action field start date, which is scheduled for the fall of 2000.

During the interim action period, additional information related to the commingling of plumes and groundwater remediation system effectiveness data will be obtained. This information and data will facilitate selection of a final groundwater remedy through development of a final CMS/FFS scheduled for submittal in the summer of 2003. The SB/PP containing the final groundwater remedy is scheduled for public comment during the first quarter of 2004, and the final ROD is scheduled for approval in the summer of 2004.

The interim action groundwater remediation system will continue to operate beyond the Stage 2 evaluation period until the final remedial alternative is agreed upon by the three Parties. The interim action will not be shut down until SCDHEC and USEPA grant permission to cease the operation.

Figure 22. Post-IROD Document Schedule



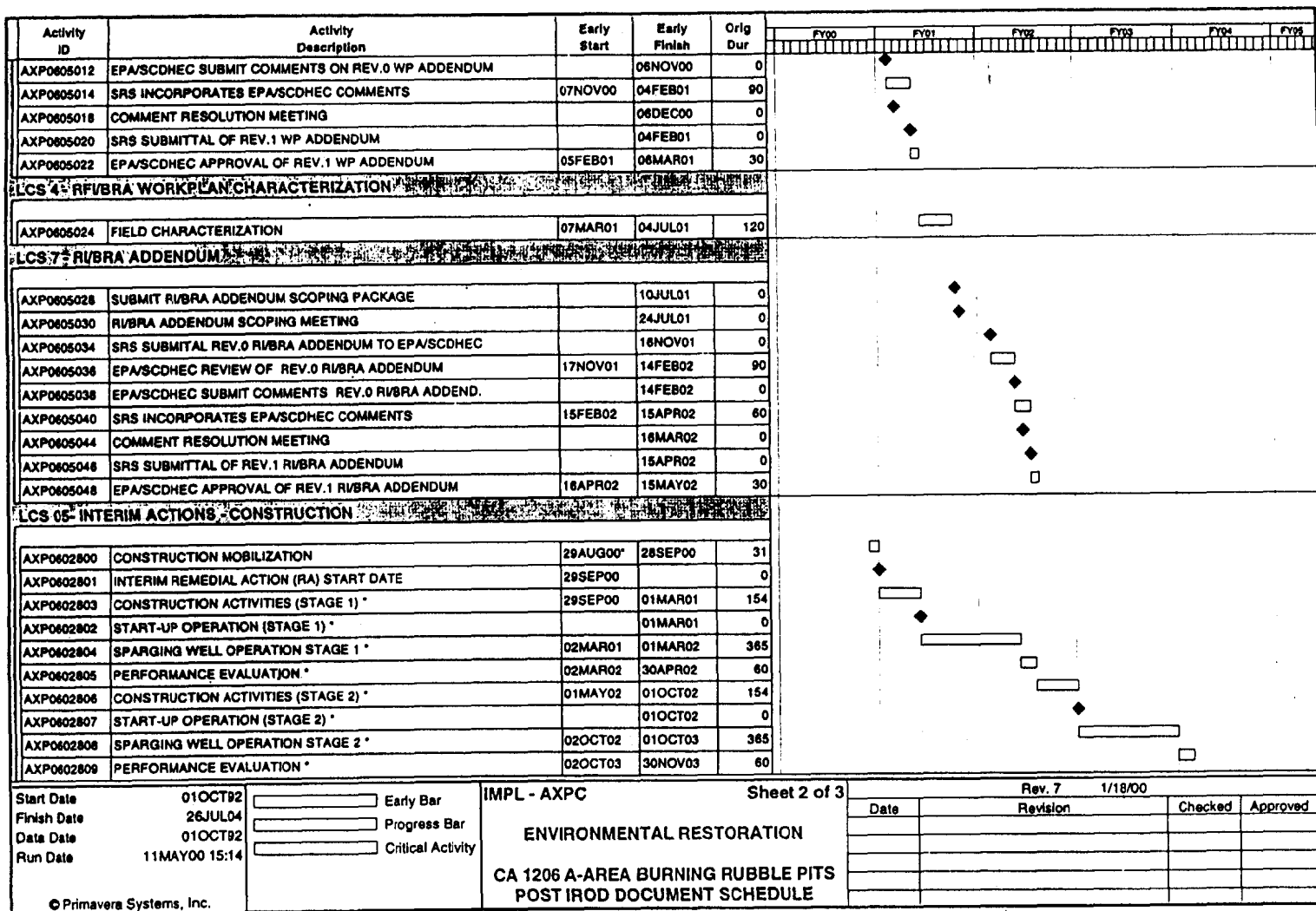
Note: This schedule is for planning purposes only and is subject to change. Dates associated with new document submittals will be finalized during Work Plan Addendum Scoping Meeting with three party core team.

IROD for the A-Area Burning/Rubble Pits (731-A1A)  
and Rubble Pit (731-2A) (U)  
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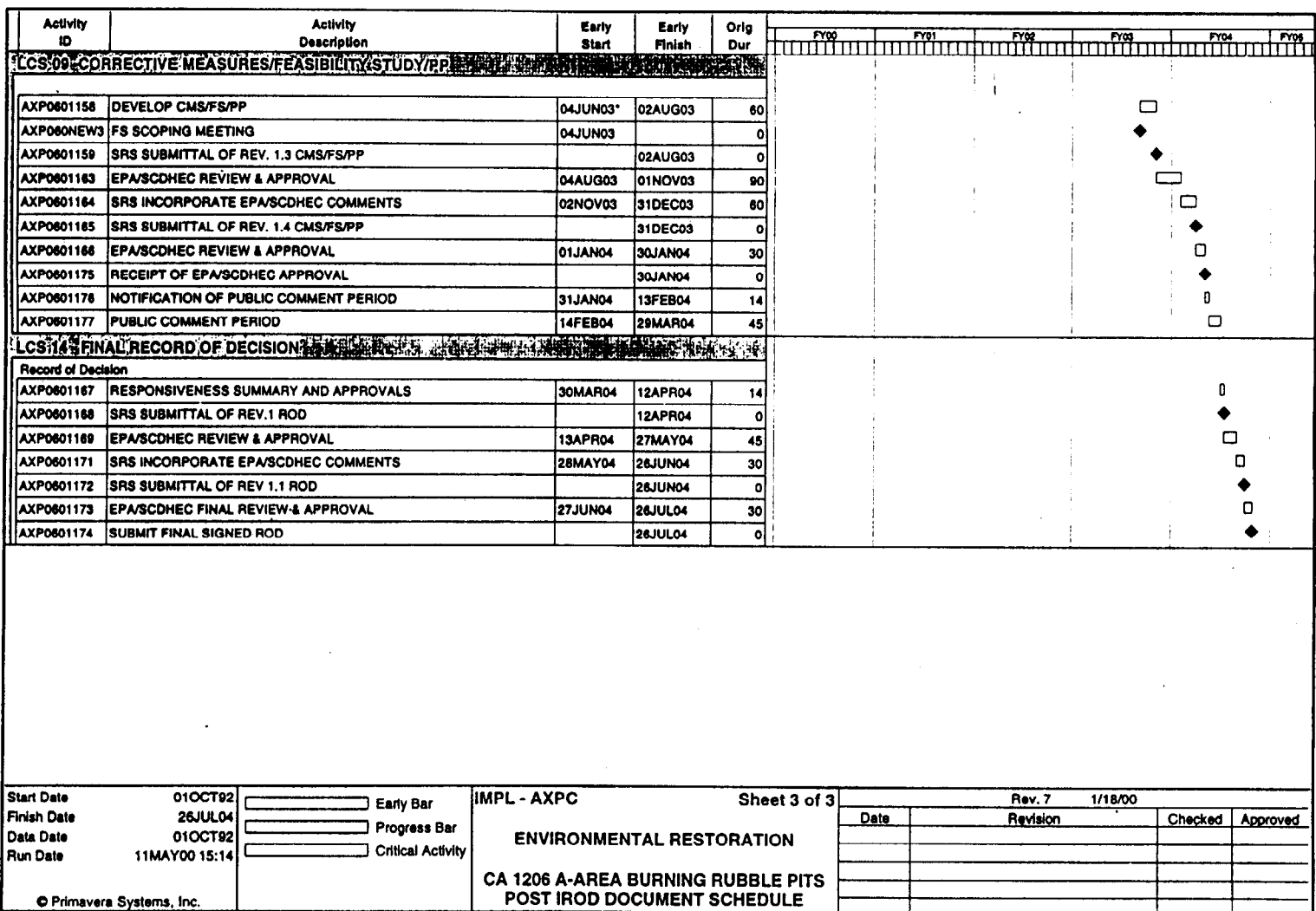
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Figure 22. Post-IROD Document Schedule (continued)



Note: This schedule is for planning purposes only and is subject to change. Dates associated with new document submittals will be finalized during Work Plan Addendum Scoping Meeting with three party core team.

Figure 22. Post-IROD Document Schedule (continued)



Notes: This schedule is for planning purposes only and is subject to change. Dates associated with new document submittals will be finalized during Work Plan Addendum Scoping Meeting with three party core team.

## **XVI. REFERENCES**

- FFA, 1993. *Federal Facility Agreement for the Savannah River Site*, Administrative Docket No. 89-05-FF, (Effective Date: August 16, 1993).
- USDOE, 1994. *Public Involvement, A Plan for Savannah River Site*. Savannah River Operations Office, Aiken South Carolina.
- USEPA, 1995. *Supplemental Guidance to RAGS: Region 4 Bulletins (Data Collection and Evaluation, Toxicity Assessment, Exposure Assessment, Risk Characterization, Development of Risk-Based Remedial Options)*. Interim Draft, Office of Technical Services, Atlanta, GA. September.
- WSRC, 1993. *Phase II, Revision 2, RCRA Facility Investigation/Remedial Investigation Work Plan for the A-Area Burning/Rubble Pits (731-A and 731-1A) and Rubble Pit (731-2A)*. WSRC-RP-91-1126, Rev. 2, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC.
- WSRC, 1997a. *RCRA Facility Investigation/ Remedial Investigation Report with Baseline Risk Assessment for the A-Area Burning/ Rubble Pits and Rubble Pit (U)*. WSRC-RP-96-00168, Revision 1.2, Westinghouse Savannah River Company, Aiken, South Carolina (June, 1997).
- WSRC, 1997b. *Corrective Measures Study/Focused Feasibility Study for the A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) (U)*. WSRC-RP-96-902, Revision 1.0, Westinghouse Savannah River Company, Aiken, South Carolina (July 1997).
- WSRC, 1999a. *Data Summary Report for the A-Area Burning/Rubble Pit Benzo(a)pyrene Sampling (U)*. WSRC-TR-99-00018, Revision 1, Westinghouse Savannah River Company, Aiken, South Carolina (June 1999).
- WSRC, 1999b. *Interim Action Proposed Plan for the A-Area Burning/Rubble Pits (731-A/1A) and Rubble Pit (731-2A) Operable Unit (U)*. WSRC-TR-99-4014, Revision 1.1, Westinghouse Savannah River Company, Aiken, South Carolina (November 1999).

## **APPENDIX A - RESPONSIVENESS SUMMARY**

### **Responsiveness Summary**

The 30-day public comment period for the ABRP IAPP began on December 21, 1999, and ended on January 19, 2000.

### ***Public Comments***

There were no comments received from the public during the IAPP public comment period. The SRS CAB Environmental Remediation and Waste Management Subcommittee was given a briefing on the preferred alternative on January 11, 2000. The subcommittee was supportive of the preferred alternative and drafted Recommendation 114, Proposed Interim Action Plan for A-Area Burning/Rubble Pit. The recommendation was presented to the full CAB at the January 25, 2000, meeting.

The comments and recommendations from Recommendation 114 support the action and read as follows:

### **Comments:**

The SRS CAB supports the proposed actions as a reasonable choice among the alternatives. However, it is the CAB's preference to spend remediation dollars toward actual cleanup and not additional study and research. In this case, the CAB recognizes the need to determine if commingling of the contaminants in the deeper aquifer has occurred.

However, the CAB believes it may be more cost-effective to remediate commingled contamination from several OU(s) instead of individual separate discrete actions. In addition, the CAB has a concern that the existing regulatory

framework will not allow a holistic approach even when it is more protective of human health and the environment.

**Recommendations:**

1. The preferred alternative for final soil remedial action and interim groundwater remedial action for ABRP be implemented.
2. The three agencies provide the Board with an opportunity to review the performance evaluations for ABRP-OU groundwater interim remedial action during the same review period as the regulators.

The SRS responses are as follows:

1. SRS thanks the CAB for their support of the selected remedy.
2. SRS agrees to provide copies of the performance evaluations for the ABRP groundwater interim remedial action to the CAB at the same time that copies are sent to the regulators for review.

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### APPENDIX B - POTENTIAL ARARS FOR ALL OF THE ALTERNATIVES

Citation	Status	Requirement Summary	Reason for Inclusion	Alternative
<b>Chemical</b>				
40 CFR 141 – Safe Drinking Water Act	Applicable	MCLs for groundwater that may be a source of drinking water	Contaminated groundwater is potentially drinking water	All GW Alternatives
SC R.61-58.5 South Carolina MCLs	Applicable	MCLs for groundwater that may be a source of drinking water	Contaminated groundwater is potentially drinking water	All GW Alternatives
SC R.61-68 Water Classification	Applicable	States the official classified water uses for all surface and groundwater in SC	Groundwater is contaminated	All GW Alternatives
<b>Action</b>				
SC R.61-71 Well Construction Standards	Applicable	Identifies minimum standards for the construction of groundwater wells	Sparging and extraction wells are required	All GW Alternatives
40 CFR 50.6	Applicable	Establishes limits for particulates in the air	Earth-moving equipment would raise dust	3S and 4S
40 CFR 61 (NESHAP)	Applicable	Identifies levels of VOCs that can be released to the atmosphere	GW remediation will release VOCs to the atmosphere	All GW alternatives
29 CFR 1910 (OSHA)	Applicable	Identifies health and safety requirements for remediation workers	For any remediation work	All GW alternatives, 3S and 4S
40 CFR 268 RCRA Land disposal restrictions	Applicable	Applicable if BAP is shipped to a waste facility	For disposing of contaminated soil offsite	3S
49 CFR 107, 171-179 DOT Regulations	Applicable	Identifies requirements for shipping soil containing hazardous materials	For shipping any soil offsite	3S
<b>Location</b>				
None				